

HORTICULTURAL ABSTRACTS.

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Vegetables and Flowers. In view of representations received for the inclusion of abstracts on vegetable and flower growing, a section dealing with these subjects is included for the first time in this number.

Abstracts. No. 305 is by H. M. Tydeman. Other abstracts in the present number are by the Bureau Staff.

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Horticultural Abstracts

Vol. II

September, 1932

No. 3

HORTICULTURE—MISCELLANEOUS.

211. LINSBAUER, L. 634/5(072)(47)
 Die gartenbauwissenschaftlichen Institute Russlands. (The horticultural
 institutes of Russia.)
Gartenbauwissenschaft, 1932, 6 : 691-3.

The following list has been prepared by the author with the help of H. F. Brethmildner of the Mitschurin Institute, Koslow. All institutes form part of the Lenin Academy for Scientific Agriculture. Apart from the numerous Agricultural Institutes which also deal with horticulture and are part of this organization, the following are devoted purely to horticulture :—

1. Vegetable Institute at Tekstilschiki, with 20 zonal substations. Results are published monthly in the "Socialist Fruit and Vegetable Growing." 2. Institute for Southern Fruit Growing at Kiev with 11 zonal substations. Results in periodical mentioned above. 3. Institute for Northern Fruit Growing at Mitschurinsk-Koslow, possessing 23 zonal stations. 4. Viticultural Institute at Tiflis. 5. Potato Institute at Malachowka. 6. Radikologisches Laboratorium at Moscow. 7. Citrus Institute at Kaukas Nowi Afon. Nos. 6 and 7 have only just come into being. [This list would not appear to be complete, nor to agree entirely with information received by the Bureau from the Institute of Applied Botany, Leningrad.—Ed.]

212. HOWELLS, D. V. 634/635 (41)
 Development of horticulture in Scotland.
Scottish J. Agr., 1932, 15 : 132-46.

The author considers that the new duties on horticultural produce give a great opportunity to Scottish horticulturists, not only by the shutting out of produce from the Continent but by the probable greater absorption in England of English-grown produce. Believing that the duties will allow of the expansion of the following crops he gives useful general notes on their cultivation, which, with the exception of currants, new potatoes, and rose trees, will have to be under glass. The crops noted are black currants, grapes, French beans, cauliflowers, lettuce, endive, tomatoes (for this there would appear to be the best prospects of all), cucumbers, flowers, e.g. cyclamen, azalea, hydrangea, lilies of the valley, spiraea. In addition notes are given on marketing, grading and packing.

213. ANON. 631.42
 A bacteriological method for determining soil deficiencies.
Calif. Citrograph, 1932, 17 : 288-9.

This method is being tested by Dr. C. H. Griffin of the Griffin-Hasson Laboratories, whose actual words are quoted in the article. The method is concerned with determining in a rapid and

inexpensive manner the amount of plant food present in a form available to the plant in any given soil. The soil sample is divided into soil plaques of a few ounces each. To each except the controls is added a different plant food element in available form. The plaques are kept under identical conditions. In three days a crop of azotobacter will have developed on each. The azotobacter, a minute organism with the power of fixing nitrogen from the atmosphere, responds to the principal mineral fertilizing elements such as lime, phosphoric acid and potash in the same degree as a field crop. From this it is argued that, if one of the treated plaques produces a better crop than the others, there is a deficiency in the field of the element used in that plaque, while, should the controls bear an equally good crop with the treated plaques, it is regarded as evidence that there is sufficient plant food for all available requirements. A several years' record of the results of fertilizer treatment administered on findings of the plaque test showed in over 90% of the cases that decided increases of crop occurred following the application of the elements indicated by the test, while no increase of crop occurred when fertilizers were applied despite the fact that the test revealed no deficiency. The test does not determine the presence of inhibiting factors such as high nitrates or boron but the specific cause of failure of azotobacter to grow on plaques in which all deficiencies have been supplied can usually be determined by chemical methods. Elements needed in a minor degree such as iron, copper and magnesium, etc., are disregarded for practical purposes, as it is considered that a soil is seldom found which does not contain them in abundance.

TREE FRUITS, DECIDUOUS.

Varieties.

214. **BOGUSHEVSKY, P. N.** 634.11
Circassian apple seedlings of the Mikhailowsky pass. [Russian—short English summary.]
Bull. Appl. Bot., 1931, 26 : 4 : 383-96.

These originated from neglected, cultivated Circassian varieties and are found to exhibit vigorous growth, good productivity and immunity to fungus disease. It is suggested that they may be useful for crossing with European varieties to obtain hybrids resistant to fungi.

215. **GUERRINI, G.** 634.16
 Appunti monografici sul Nespolo del Giappone in Liguria. (*Notes on loquat growing in Liguria.*)
L'Italia Agricola, 1932, 69 : 533-44.

The loquat or Japanese Medlar (*Eriobotrya japonica*) is a fruit tree which seems to merit considerably more attention than it has hitherto received. Growth in Italy as elsewhere has so far been somewhat casual and the delicious fruits which a loquat can produce are the exception rather than the rule. The total sugar content of its fruits is moreover very high, 10-11%.* The writer utters a reasoned plea for its cultivation on a commercial scale under scientific management. He describes and gives advice on the best known methods of cultivation. He puts its life at 60 years with a maximum annual production from the 15th to the 40th year of about 12 cwt. per acre (15 quintals per hectare). Present methods of propagation are (1) direct from seed on own roots, (2) worked on hawthorn, on which it is found to bear large fruits of good flavour but late and somewhat delicate, (3) worked on quince, which tends to make it hardy, (4) worked on seedling loquat. The scions taken from two-year-old wood may be crown grafted

* Analysis by Prof. Baltrager of Palermo.

in the seed bed in the 3rd year or after transplanting in the 4th year, or, what is more commonly preferred, budding may be done on a seedling not less than 3 years old in April or May, and in the event of failure the process may be repeated with a dormant bud in July. Fruiting takes place at the tips of the shoots, a fact which must be remembered when pruning. The tree is evergreen and pruning takes place at the end of summer. The tree is trained so as not to exceed 1.50-1.60 m. in height to avoid wind damage. As cultivated at present the loquat appears to be extremely hardy. The most serious disease experienced is a variety of *Fusicladium dendriticum*, which may cause blackening and fall of the fruits. Some varieties are more resistant to this than others. Ants may be troublesome as pests as well as a moth, *Sesia myopiiformis*, the larvae of which bore between bark and wood and may cause complete girdling. For all the above there are adequate remedies, an account of which is given. Five varieties are named, all of which have some particular merit, and a specimen costings sheet is given for Italian conditions.

Propagation.

216. SHAMEL, A. D., AND POMEROY, C. S. 634.11 : 575.252
Bud variation in apples. A study of the rôle of bud mutation in deciduous fruit improvement.

J. Hered., 1932, 23 : 173-80 and 213-21, bibl. 36.

For a valid estimate of the value to the industry of eliminating undesirable limbs or trees, one could wish that the writers gave some indication of the percentage incidence of bud sporting in orchards. That the phenomenon occurs, and how in many cases it has been turned to good use, is adequately shown by them. A list is given of 173 apple bud variations recorded prior to August 15th, 1931. Of these 143 differed by showing a particularly deep colour, 3 a green, 3 a striped, and 3 a russet colour in their fruits, 10 produced very large fruits, 6 curiously shaped, i.e. flattened, oblong or twin fruits, 3 matured their fruits earlier, 1 showed a tendency to annual cropping, 1 possessed seedless fruits. Of the variations, 38 were found in Delicious trees, 21 in Winesap, 12 in Rome Beauty, 10 each in Stayman Winesap and Northern Spy. Most of them were found as limb variations, though a few were whole tree variations. A short account is given of the characteristics of such popular colour sports as Starking and Richared of the Delicious, Staymared and Blaxtayman of Stayman Winesap, Blackjon, a sport of Jonathan, and a sport of the Esopus. As regards the Starking it is noted that the deep red colour developed may lead to premature picking, unless the fact of deeper colouring at an early date is realized. [See also *H.A.*, 1932, 2 : 1 : 9.—Ed.] The authors consider that the phenomenon makes the keeping of apple tree performance records essential in order (1) to be able to compare the results of experiments, (2) to eliminate undesirable limbs or trees by topworking or replanting, and (3) to select particularly promising variations for progeny tests (either by top working or after ordinary budding) and, if the variations persist, to propagate them. The fact that most of the sports so far noted are colour sports is attributed by the writers to the ease with which this variation can be seen.

Rootstocks.

217. LAGASSÉ, F. S. 634.11-1.541.11/12-1.547
A comparison of the variability in growth of several varieties of apple trees growing on seedling roots and upon their own roots.

Proc. Amer. Soc. Hort. Sci., 1931, 28 : 475-84, bibl. 11.

The scion-rooted trees were produced by the long scion-nurse root method (Auchter, *ibidem*, 1925), the seedling or nurse root being removed above the graft union on transplanting.

They were compared with 2-year-old trees of the same varieties on seedling roots. The orchard at planting consisted of 2 rows each of Yellow Transparent, Stayman Winesap and Delicious, 40 scion-rooted and 40 on seedling roots of each variety, 4 rows of Grime's Golden, 80 scion-rooted, 80 on seedling roots, and 6 rows of Rome Beauty, 120 being scion-rooted and 120 on seedlings. At the beginning of the experiment the coefficients of variability with respect to the weight, height and circumference of the trees were much greater in the scion-rooted trees, the Yellow Transparents alone showing a certain deviation. All varieties on seedling roots had greater weight, height and circumference with the exception of height in Rome Beauty and Stayman Winesap.

After 3 seasons' growth it was found that as regards height the coefficient of variability had decreased in scion roots, while it had increased on seedling roots except in Yellow Transparent and Grime's Golden. Moreover the difference in circumferential, i.e. girth, variability between the two groups had been much reduced owing largely to the increasing variability in the trees on seedling roots. The removal of the seedling roots from scion-rooted trees obviously did not disrupt the metabolism of the tree for long, as might have been expected, for it is apparent that these trees have grown very well in comparison with the trees on seedling roots, and that their tendency to remain rather constant with respect to their original variability has not been at the expense of growth.

218. PEARL, R. T.

634.11-1.541.11/12

Apple rootstocks I.—XVI.

J. South-Eastern Agr. Coll., Wye, 1932, No. 30, pp. 194-214, bibl. 59.

The author has accomplished the extremely useful task of collecting and correlating the evidence available on the vegetatively reproduced apple stocks under investigation by the staff of the East Malling Research Station. Evidence given in published articles has in many cases been amplified by private discussion and the result is a thoroughly clear, though condensed, account of the present position. The article is written from a practical standpoint and the information should act as a useful guide to the grower or still more to the horticultural adviser. To those who demand fuller details of individual points, his bibliography of publications by the East Malling staff on particular aspects shows the path to knowledge. The original provisional classification of stocks into "Dwarfing," "Semi-Dwarfing," "Vigorous" and "Very Vigorous" groups, has on the whole been confirmed subject only to certain modifications. The factors which in the author's opinion necessitate modification are discussed under the following headings:—*Stock habit*. The habit of the rootstock on its own roots is not always reflected in a similar habit induced in the scion. *Early vigour*. This is not always an index of ultimate size. *Growth and cropping*. Stocks inducing comparable vigour show significant differences in cropping propensities induced. *Age*. The experimental trees are still young. So far rootstock influence appears to become more marked with age. *Soil conditions*. The relative order of vigour and cropping is retained irrespective of soil, but the actual vigour and cropping propensities may vary. *Nutritional conditions*. Under conditions of nutritional deficiency, especially potash, certain rootstocks, above all those in the semi-dwarfing group, tend to behave abnormally. *Cultural manipulations*. These may modify or mask normal rootstock influence. *Local conditions*. Environmental conditions may modify particular characteristics of specific rootstocks. *Varietal preferences*. Stock-scion partialities and delayed or partial incompatibilities are possible. *Scion-rooting*. Probably trees are very prone to scion-rooting when they are worked on growth-restricting, dwarfing stocks and are planted deep. When the maintenance of a specific influence is required, trees should be planted with the union above the ground. The stocks are discussed in turn and the following recommendations, based on a consideration of the observed characteristics, made:—(1) *Very Dwarfing Stocks*. IX is recommended, while rejection is suggested for VIII. (2) *Semi-Dwarfing Stocks*. II is recommended, while further trial is suggested for VII and rejection for III and V. (3) *Vigorous Stocks*. I is recommended. Rejection suggested for IV, VI, X and XI. (4) *Very Vigorous Stocks*. Recommended for further trial XII, XIII, XVI and possibly XV, rejection suggested for XIV.

Pollination.

219. HOOPER, C. H. 634.23 : 581.162.3

Pollination in relation to cherry orchards.

J. South-Eastern Agr. Coll., Wye, 1932, No. 30, pp. 244-6, bibl. 3.

This is a continuation of the author's studies on cherry pollination, of which a short account was given two years ago in the same journal (1930, No. 27, pp. 202-4). He states that the details given are culled chiefly from investigations at the John Innes Horticultural Institution at Merton, England, but also from American, Australian and Swedish sources. He does not give the actual source in each case. The information consists of a further list of varieties of cherries given in approximate average order of flowering, together with the names of good pollenizers for those varieties.

220. PHILP, G. L., AND VANSSELL, G. H. 634.1/2 : 581.162.3

Pollination of deciduous fruits by bees.

Calif. Agr. Extension Service circular 62, 1932, pp. 27.

The writers give details of the pollination compatibilities under Californian conditions of common varieties of the following fruits:—almonds, apples, cherries, pears, plums and prunes. They then describe the method by which the bee acts as a pollen distributor: They consider that at least one hive per acre is necessary to insure pollination, the hives being grouped in tens or twenties to suit local wind and weather conditions.

221. TRENKLE, R. 634.1/2 : 581.162.3

Zur Frage der praktischen Auswertung der Untersuchungsergebnisse über die Befruchtungsverhältnisse bei Stein-u. Kernobst. (**The practical application of pollination investigations on stone and pome fruits.**)

Gartenbauwissenschaft, 1932, 6 : 637-49, bibl. 22.

This is a discussion of the somewhat emphatic views of certain other Central European authorities on fruit pollination. The author, referring to the much debated point of the influence of climatic and nutritional factors, states that his own experiments and observations lead him to agree with Branscheidt and others, who consider that nutritional conditions, in the widest sense, play a certain rôle in fertilization in general and also in self-fertilization.

222. KRUMBHOLZ, G. 634.11 : 575.18

Untersuchungen ueber das Vorkommen von Xenien und Metaxenien bei Äpfeln. (**Experiments on the occurrence of xenia and metaxenia in apples.**)

Gartenbauwissenschaft, 1932, 6 : 404-24, bibl. 25.

The author describes experiments undertaken for 1-3 years in which Ananas Reinette, Graue Herbstrenette and Canada Reinette were fertilized with pollen from various other apple varieties. No instance of xenia occurrence was observed in the seeds and metaxenia was also absent in the fruits. There were indications, however, that the actual size of the fruit was influenced by the pollen variety used. For example fruits were generally much greater when the pollen variety was Baumann's Reinette than when Kaiser Alexander was used. In view of the different uses to which the terms xenia and metaxenia are put, he gives his own definition as follows:—"By 'xenias' we imply well developed (heterozygote) hybrid embryos or hybrid endosperms which show morphological or physiological deviations from the normal homozygous tissues, such deviations being attributed to the influence of the male parent nucleus and recalling characteristics of the male parent. Such xenia occurrence may be shown by changes in shape, size and colour of the whole seed, without in any way altering the pure mother elements in the seed coat. We agree with Swingle in speaking of 'metaxenia' when, under the influence of the hybrid embryo or endosperm, such deviations occur in those parts of the fruit which are formed from the mother parent, such as the seed coat or the surrounding fruit tissues."

Growth, Nutrition.

223. CULLINAN, F. P. 634.25-1.8: 581.192
Some relationships between tree response and internal composition of shoots of the peach.

Proc. Amer. Soc. Hort. Sci., 1931, 28: 1-5, bibl. 2.

This is a summary of results obtained from testing the composition and length increase of peach shoots following various manurial treatments. Data secured in the above trial indicate that shoot growth may vary in internal composition under different conditions of nutrition.

224. JONES, I. D. 634.25-1.432.2: 581.144.4: 581.145
Preliminary report on relation of soil moisture and leaf area to fruit development of the Georgia Belle peach.

Proc. Amer. Soc. Hort. Sci., 1931, 28: 6-14, bibl. 8.

The following observations were made after one season:—(1) Increases in leaf-to-fruit ratios on ringed branches resulted in increasingly larger fruits, and, to a limited extent, in the hastening of fruit development and ripening. (2) Fruit from trees under different moisture conditions was correspondingly different in size irrespective of leaf-to-fruit ratios. Increase in moisture supply favoured increased size of fruit both on ringed and unringed branches. (3) Reduction of soil moisture under relatively constant atmospheric conditions resulted in shortening the period in which stomata were open and hence functioning in food elaboration. (4) The minimum leaf area favouring the production of high quality fruit varied markedly under different soil moisture treatments.

225. HINTON, J. C., AND OTHERS. 634.11: 581.192
Further observations on the influence of position in the cluster on the quality of apples.

Long Ashton Ann. Rept. for 1931, 1932, pp. 68-76, bibl. 8.

Experiments are in progress on Allington Pippin and Bramley's Seedling apples in conjunction with a fruit thinning trial. Results observed to date are stated by the author to be not entirely understood. In further work the possibility of a maturity factor and the effect of thinning will be considered. Results noted are:—(1) after thinning, lateral fruits of both varieties contained 50% more sucrose at normal picking date than the corresponding terminal fruits, showed no significant difference in acid content from them, in the case of Allingtons lost sucrose and total weight more quickly in storage than did the terminal fruits; (2) thinning to 1 fruit per cluster with Bramleys resulted in an increased sucrose concentration in all fruits, an equalization in sucrose concentration in lateral and terminal fruits, and a slightly greater concentration of acid in lateral than in terminal fruits; (3) the rate of loss of total weight in storage was greater in all lateral fruits, irrespective of thinning, than in terminal fruits. The ash constituents in Bramley's Seedling apples were similar in amounts and did not consistently differ according to position in cluster or to thinning treatment.

226. OVERHOLSER, E. L., AND CLAYPOOL, L. L. 634.25: 581.144.4: 581.192
The relation of leaf area per peach to physical properties and chemical composition.

Proc. Amer. Soc. Hort. Sci., 1931, 28: 15-17.

One year's observations showed that on unringed branches the size of leaves varied inversely with the number of leaves per fruit, though no such correlation was noted on ringed branches. They indicated moreover that the chemical composition of the peaches was influenced by the greater number of leaves per fruit, in that nitrogen and moisture percentage possibly tended to decrease and total sugars and sucrose percentages to increase. Fruit from ringed branches tended to show a higher average percentage of ash, reducing and total sugars than that from unringed.

227. WEINBERGER, J. H. 634.25-1.55 : 581.144.4

The relation of leaf area to size and quality of peaches.

Proc. Amer. Soc. Hort. Sci., 1931, 28 : 18-22, bibl. 3.

Leaving very few leaves per fruit resulted in poor quality and flavour in the fruit. Minimum acidity was associated with 30 leaves per fruit, the acidity increasing with smaller or larger leaf areas per fruit. But whereas the greater acidity of fruit grown with the smaller leaf areas had a bad effect on quality, being accompanied by a low sugar content, that of fruit grown with the larger leaf areas was accompanied by an increased sugar content and improved quality. Increased leaf area per fruit resulted in increased size but decreased total amount of fruit.

228. PENTZER, W. T., AND OTHERS. 664.85.13.037

Investigations on harvesting and handling fall and winter pears.

U.S.A. Agr. tech. bull. 290, 1932, pp. 29, bibl. 13.

The authors note that the use of the pressure test, correlated with the ground colour of the fruit, which should correspond with one of the four colours in a chart which is given in the bulletin, is increasing in the Pacific Coast States. The pressure test and colour numbers which ensure the best storage results are given for a number of pears. For longest storage life they recommend a storage temperature of 30-31° F., noting that a lowered transit temperature of precooled shipments generally added 1-2 months to the subsequent storage life at 31° F. They consider that at 32° F. Easter Beurre and Winter Nelis can be held 7-8 months, Bosc 2-3, Clairgeau 4-6, Comice and Hardy 2-4 and Anjou 4-5 months.

229. MOORE, J. C. 634.13-1.547.6 : 541.13

Electrical resistance of pear tissue as an index of maturity.

Oregon State Agr. Coll. Agr. Exp. Sta. bull. 300, 1932, pp. 18, bibl. 10.

This is a preliminary report on experiments in progress. Materials used for determining resistance of Bartlett, Anjou and Bosc pears were 1 Weston 301 millimeter graduated in .02 MA range 0-1 MA ; 1 Weston 301 voltmeter graduated in .2 volt, range 0-6 volts ; 1 Yaxley 400-ohm potentiometer ; 1 4-5 volt Radio "C" battery ; 1 pair copper electrodes 5 mm. square, set 5 mm. apart, connected with about 3 ft. copper wire. These were assembled as an ohm-meter. A diagrammatic sketch is given of the apparatus in action and data obtained in the field and in cold storage are discussed. Distinct indications are given by results to date that the degree of maturity in pears may be satisfactorily measured by this method.

230. ALLEN, F. W. 634.1/2-1.547.6 : 581.192

Physical and chemical changes in the ripening of deciduous fruits.

Hilgardia, 1932, 6 : 13 : 381-441, bibl. 41.

Among the conclusions deduced by the author are the following. Plums can develop their full colour during transit, whereas apples, peaches, pears and apricots normally need sunlight for this. Fruits soften rapidly after colour starts to change, thus with Bartlett pears softening may begin when the fruit has reached only half its size. Climatic conditions and type of rootstock are important factors in the softening of Bartletts. After harvesting softening largely depends on temperature. Plums held at 43° F. for 12 days softened about as much as comparable samples kept at 52° F. for 6 days. Bartletts soften 1-2 lb. (measured by mechanical pressure tester) in several months at 32° F., while at 36° F. they will ripen two to three times as fast. Plums, peaches and pears all show an increase in soluble solids as the fruit ripens on the tree. The quantity of soluble solids is roughly twice that of the total sugars. All fruits analysed made a material gain in sugar content as the fruit coloured on the tree. The stone fruits gained in sucrose, apples in both sucrose and reducing sugars, pears primarily in reducing sugars. During maturity on the tree the acid of apricots, apples and most plums and peaches shows a decrease, though with peaches and Bartletts grown under certain conditions

(as in the case of those from the Sierra foothills) an increase may be found. The question of the varying resistance to electric current at differing stages of maturity, which may act as a guide to time of picking, needs further investigation. Treating Gravenstein apples with ethylene resulted in hastening softening and increasing the yellow colour without increasing the dessert qualities and can scarcely be recommended for commercial shipments. A limited number of analyses with Beurre Bosc and Winter Nelis pears showed the sugar and acid content of the fruit to be scarcely affected by the treatment.

231. HINTON, J. C. 634.11-1.547.6

Studies on maturity of fruit. I. Introductory. II. Preliminary observations on the rate of softening of apples. III. Starch content in relation to maturity of apples grown under various orchard conditions.

Long Ashton Ann. Rept. for 1931, 1932, pp. 40-53, bibl. 38 and 54-67, bibl. 3.

In the introductory section the author discusses the results of other investigations, first those which throw light on the effect of maturity on commercial quality and in particular storage quality, and secondly those bearing on the fundamental processes of the metabolism of the fruit. At Long Ashton the pressure tester recommended by Murneek with a plunger $\frac{1}{2}$ " in diameter and a penetration of $\frac{3}{16}$ " was used on Newton Wonder apples grown under the following conditions:—(1) clean cultivation, (2) grass, (3) clean cultivation, the trees being older than in (1) and (2), and being grown in a different part of the orchard, (4) as in (3) but ringed. It was also used on Grenadier apples grown under grass. Among the "tentative conclusions" drawn by the author from his preliminary results are the following:—1. The rate of softening after picking is greater in later pickings (to this one exception was found); 2. Fruits from ringed trees and from trees grown under grass soften less quickly after picking than those from comparable non-ringed trees grown under cultivation; 3. Immaturity in ringed and grassed fruits may be associated with the increased availability of food on the ringed and grassed trees, which are known to produce fruits with greater contents of solids, particularly soluble carbohydrates; 4. No definite conclusions can be drawn from the rates of softening of the apples whilst still on the trees. Interesting points brought out by the author as the result of his starch tests include the following:—the starch-iodine test was used to determine starch content. In no case did samples tested at picking time develop any significant amount of bitter-pit in storage, although they were at different stages of picking maturity. The rate, moreover, at which starch disappears from apples during storage as indicated by this test differs in different samples. This rate may be a useful index of the rate of maturing. Difficulties are noted in the satisfactory use of the starch-iodine test, especially when applied only at picking time, differences in the intensity of the starch deposit and variation between individuals being responsible and making more detailed examination desirable. Despite this a correlation has been found in many cases between food supply favourable to the developing fruits and the relative immaturity of the latter. In some samples, where both potash deficiency and thinning or ringing are involved, results are contrary to this correlation. In the majority of cases examined fruits which had been growing under conditions of relatively favourable food supply were apparently ripening at a slower rate than comparable fruits which had not been so well supplied.

Cultural practice, Manuring.

232. DICKSON, G. H. 634.22-1.542.27

Results of a seven-year plum thinning experiment.

Scientific Agriculture, 1932, 12: 646-51, bibl. 3.

These thinning experiments were initiated in 1922 as a result of observations which tended to show that trees in well cared for plantations suffered less from winter injury than in those receiving less attention. From this it was thought that judicious thinning, by maintaining the

vigour of the tree, might render it less susceptible. The possibility that annual bearing might also thus be established and maintained was considered. The experiments were carried out on seven *Domestica* varieties of 12 trees each standing in adjoining rows on a heavy clay loam. The trees were fifteen years old, strong and healthy, having hitherto received uniform orchard treatment including thinning, the only exception being that 4 trees had been left unthinned in 1922. The varieties used in the experiment were Reine Claude, Gueii, Duane, Ponds, Washington, Lombard, Yellow Egg. Four trees of each variety distributed throughout the plots were left unthinned as controls, the remainder being thinned annually (when the crop was sufficient) immediately following the June drop. An analysis of the results after seven years revealed that the total yield was not materially influenced by thinning, except where excessive bearing had devitalized the unthinned trees and winter injury followed. Thinning by increasing the size of the fruit made the thinned product of greater economic value than the unthinned. Thinning materially assisted in checking the spread of brown rot. A heavy yield delayed maturity and retarded the bloom in the succeeding year. Thinning did not induce annual bearing in the varieties under experiment.

233. THOMAS, W.

634.11-1.8 : 581.192

Composition of current and previous season's branch growth in relation to vegetative and reproductive responses in *Pyrus Malus* L.*

Plant Physiology, 1932, 7 : 390-445, bibl. 232.

The author gives an amply documented account of the theories on the response of plants to fertilizing elements and then proceeds to describe his own experiments in detail. In these standardized, vegetatively propagated stocks, whip grafted to scions from a tree of known history, were planted in a virgin soil contained in 5' x 5.5' boiler plate cylinders, sunk in the ground and isolated from the surrounding soil by a 6" layer of crushed limestone. Two years after planting the trees were subjected to different combinations of the pure salts NaNO_3 , $\text{CaH}_4(\text{PO}_4)_2 \cdot 2\text{H}_2\text{O}$, and K_2SO_4 at very low concentrations in the spring of each year. Marked differences, absent previously, were visible within a few months and became intensified as the experiment continued. During 1925-6 analyses of the one year and season's branch growth with respect to certain elements were made at critical periods in the seasonal growth of the trees under sod. The bark and wood were examined separately. The reproductive responses are indicated by the number of blossom clusters formed during this period. *Under cultivation* : NPK 353 ; NP 334 ; N 71 ; PK 28 ; NK 17 ; P 13 ; check 6. *Under Sod* : NPK 328 ; NP 145 ; NK 102 ; N 21 ; PK 0 ; check 0. Branch elongation followed the same order relative to treatment. The author notes the effects of the different treatments on the course of sugar content ; invertase activity ; the content, storage and activity of starch ; nitrogen content ; carbohydrate content ; ash percentage.

The energy relations of glucose and starch are examined and discussed. The literature on the physiological function of the hemicelluloses as reserve material is briefly reviewed. Nitrogen concentration was found in these experiments to be the principal factor that determined the utilization of accumulated starch ; but increased phosphorus and potassium concentrations in the tissues examined also stimulated additional utilization, resulting in increased fruit bud formation. The author considers that his experiments indicate that the carbohydrate : nitrogen ratio serves, under conditions ordinarily encountered in the field, as one of the most sensitive measurable indices of physiological balance at present available. This ratio showed a definite gradient relative to the treatments in the following ascending series : NPK < NP < NK < PK < P < check.

The rôle of potassium is discussed, the author considering that the mechanism of its action is very complex and is probably the resultant of photoelectric as well as radioactive properties. Applications of potassium and of nitrogen increased the absorption of phosphorus. The starch : P_2O_5 and the available carbohydrate : P_2O_5 ratios indicated that phosphorus may act as an accessory accelerator of respiration only in the presence of adequate supplies of nitrogen and potassium.

* See also 235.

234. STAGMEYR, E.

634.1/3-1.8

Artificial fertilizers for higher quality yields of fruit.*South African Fruit Grower*, 1932, 19 : 145-147.

In an article warning South African fruit farmers of the inadvisability of dispensing with the use of fertilizers as a means of economy the following examples of improvement in quality due to their proper use are given. On the Rhodes Fruit Farm, Boschendal, an experiment was started 4 years ago to discover the effect of potash on the keeping qualities of Bon Chr tien pears. The trees, which were of full bearing age, received 600 lb. superphosphate, 250 lb. sulphate of ammonia and 300 lb. sulphate of potash per acre. The control trees had similar treatment without the potash. The effect of the potash was very marked. Samples of the pears placed in cold storage on harvesting were examined from time to time. The pears from the potash treated plots at the final examination two months after picking were generally unshrivelled and full with a firm skin and good colour, the wastage being 19.4%. The pears which had not received potash showed rapid discoloration and shrivelling and at the final examination showed 40.7% waste. All pears still eatable were regarded as sound. On Mr. J. Green's farm, Die Oude Burgh, Elgin, working with York Imperial apples, sulphate of potash was used in addition to a phosphatic nitrogenous treatment. It is stated that the average increase of yield due to potash was 752 lb. per acre and that the quality of the apples improved. An experiment carried out on Navel oranges on Messrs. Visser's farm, Hex River, Citrusdal, over a period of six years to ascertain the crop-producing effects of phosphoric oxide, nitrogen and potash, proved that a well-balanced fertilizer was necessary for the highest returns. The average yield with a complete fertilizer was 437 boxes, while the incomplete fertilizer without potash yielded only 332 boxes. These potash-lacking fruits were also less palatable and, after storage, a poorer colour as regards the flesh. In the treatment of vines on Mr. D. Krige's farm, Bonte-river, it was found that applying the saccharometer test a phosphatic potassic dressing gave 18.6 Balling against 16.4 Balling, when organic manure alone was applied, while in an experiment of the Alphen farm, Constantia, potash when added to a phosphatic nitrogen treatment increased the content from 16.9 Balling to 18.0 Balling.

235. ANTHONY, R. D., AND CLARKE, JR., W. S.

634.11-1.8 : 581.084.1

Growth record of fertilized apple trees grown in metal cylinders.**J. Agr. Res.*, 1932, 44 : 245-66, bibl. 12.

These experiments were made with Stayman Winesap worked on Malling XII stocks in cylinders of $\frac{3}{8}$ inch boiler plate, 5 feet across and $5\frac{1}{2}$ feet deep. The cylinders were sunk in the ground to within 6 inches of the top. The area of each rim was approximately one twenty-two-hundredths of an acre. Each rim held about 5 tons of soil. The bottoms of the cylinders were open and set on several inches of coarse, crushed limestone, the first 3 or 4 inches of the filling being also of this material. The soil for filling was taken from an area which had received little, if any, fertilizer. It was dug in 3 layers, the first $9\frac{1}{2}$ inches deep, the second $9\frac{1}{2}$ to $18\frac{1}{2}$ inches, and the third $18\frac{1}{2}$ to 60 inches. Each layer was thoroughly mixed and replaced in its original order in the cylinders. Results, which are submitted to statistical analysis, lead the authors to the following conclusions:—There is a high positive correlation (usually over + 0.8) between the various growth factors studied, i.e. weight of tops, weight of roots, trunk diameter and branch elongation. The studies of blossom production, yield and tree growth indicate that blossom production is most highly correlated with total branch elongation and bearing surface, but that in these trees yield has a somewhat lower correlation with tree growth. Sod, without N, checked growth very seriously, even when P and K were applied. When N, especially in combination with P, was applied to sod, the growth was nearly as good as that of cultivated trees receiving the same treatment. Trees cultivated but without additional N were not so vigorous as those cultivated and receiving N. P applied alone to trees under sod increased growth : P applied to trees under sod already receiving N had little effect : but P added to trees under sod already receiving N and K increased growth. The addition of K to N or P or to N + P did not modify the growth, but may have increased fruit setting.

* For physiological deductions, see 233.

236. BEAUMONT, J. H., AND WILLIAMS, C. F. 634.25-1.84-1.55
Preliminary report of effects of time and rate of nitrate fertilization on growth and yield of Elberta peaches.
Proc. Amer. Soc. Hort. Sci., 1931, 28 : 34-8.

The trials were made on 8-year-old Elberta trees. Nitrogen applications amounting to $\frac{3}{4}$, $1\frac{1}{2}$, 3 and 6 lb. of sodium nitrate were given immediately preceding full bloom, after the crop had set, i.e. at the time of the June drop, immediately after harvest, and in November when the trees were becoming dormant (in the last case only 3 treatments were tried, one being the application of $1\frac{1}{2}$ lb. and the other two of 3 lb.). Resultant data in the first year merely gave indication of trends, but in the second yielded more definite results. Yield was proportional to earliness of application in every instance, the average yield being approximately the same for all groups except for the $\frac{3}{4}$ lb. group which was the lowest. Early applications were found to delay maturity in relation to the amount applied. Applications at the time of the June drop delayed maturity more than earlier applications.

237. LOTT, R. V. 634.25-1.84 : 581.192
Some fruiting responses of the peach to applications of nitrate of soda.
Proc. Amer. Soc. Hort. Sci., 1931, 28 : 23-7, bibl. 4.
 ASHLEY, T. E. 634.25-1.84 : 581.192
Some vegetative responses of the peach to applications of nitrate of soda.
Proc. Amer. Soc. Hort. Sci., 1931, 28 : 28-33, bibl. 4.

Spring applications of NaNO_3 to 6-year-old Elberta peaches of moderate vigour delayed maturity as gauged by the Blake pressure tester. An increase in rate of application of NaNO_3 was associated with an increase in percentage of water-soluble and total nitrogen and a decrease in the percentage of reducing and total sugars in the fruit. Experiments proved the necessity, when using the pressure tester, of using it at exactly the same relative position on all fruit to be examined.

The treatments given were 0, 3, 6, 9 and 12 lb. NaNO_3 per tree. Results on shoot growth were noted in the case of no application, 6 lb. and 12 lb. The 6 lb. application resulted in most shoots and greatest number of short shoots. The 12 lb. application resulted in the greatest total inches of shoot growth, most shoots over 12", most secondary shoots and the greatest average shoot length.

Increased rate of application was followed by:—increase in percentage and amount per unit length of water-soluble and total nitrogen in the shoots, decrease in percentage and amount per unit length of starch in the shoots, increase in leaf area, increase in water-soluble and total nitrogen in the leaves.

238. MAGNESS, J. R., AND OVERLEY, F. L. 664.85.11 : 631.8
Effect of fertilizers on storage qualities of apples.
Proc. Amer. Soc. Hort. Sci., 1929, 26 : 180-1.
 OVERLEY, F. L., AND OVERHOLSER, E. L. 664.85.11 : 631.8
Some effects of fertilizer upon storage response of Jonathan Apples.
Proc. Amer. Soc. Hort. Sci., 1931, 28 : 572-7, bibl. 6.

It was found in the first two years that no significant variation in the rate of softening as measured by the pressure tester could be attributed to fertilizer treatment. The manured plots received the following amounts of fertilizer element:—N (1 lb. per tree), P (1 lb. P_2O_5 per tree), K (2.5 lb. K_2O per tree), NP, NK, PK, NPK. No consistent measurable influence of the fertilizer treatments upon firmness of texture could be found. The highest average pressure tests were with fruit from the plot receiving potassium only, which plot produced the smallest and most highly-coloured fruit. The lowest pressure tests were from plots receiving nitrogen either alone or in

combination with other elements, all the nitrogen plots tending to produce large and low-coloured fruit. Results of observations in Jonathan breakdown over 4 years show that breakdown varied according to season regardless of fertilizer treatment. It is thought that differences in breakdown shown between the various fertilizer plots may be due to variations in the leaf area ratio or in size of fruit, or to some other factor such as climate, rather than to the direct effect of fertilizers.

239. ALDRICH, W. W. 634.11-1.84 : 581.13
Nitrogen intake and translocation in apple trees following fall, winter and spring sodium nitrate applications.
Proc. Amer. Soc. Hort. Sci., 1931, 28 : 532-8, bibl. 7.

These experiments were made on small nitrogen-deficient York Imperial apples, which received 10 lb. of sodium nitrate per tree, some trees on November 1st, some on January 1st and some on March 5th. Determination was made of the nitrogen content of rootlets, roots, terminals and spurs on different dates. The increase in nitrogen during the winter in the feeding rootlets indicates that they were absorbing nitrogen. A decrease found during the winter in total nitrogen in the medium-sized roots of the check trees indicates that nitrogen moves more quickly out of these roots than it moves in. The above facts taken in conjunction with observations by other workers, such as Eckerson and Sullivan and Kraybill, point to active nitrogen movement and metabolism in apple roots during winter. The terminals and spurs of the fall or winter manured trees did not show appreciable nitrogen increases as compared with those of the unmanured trees, a fact which indicates that the nitrogen absorbed was not translocated to the growing points during the winter. Data do not show what fraction of the nitrogen taken in by the medium-sized roots and passed on from them moved into the very large roots, the trunk or the scaffold limbs.

Plant protection.

240. CHANDLER, W. H., AND OTHERS. 634.1/2-2.1
Little leaf or Rosette in fruit trees.
Proc. Amer. Soc. Hort. Sci., 1931, 28 : 556-60, bibl. 4.

The symptom which allows the identification of this physiological disease with most certainty is the opening in spring of tufts or rosettes of leaves that are very small, rarely as much as 5% of the normal area for the variety. In many orchards trees make normal or exceptionally strong growth during the first few years, showing mottling in late summer of the 3rd or 4th year. The conditions under which the phenomenon occurs are extremely diverse, though its incidence is most pronounced in trees growing in deep, well drained; sandy or gravelly soils, possessing little clay. Attempts to remedy the condition by applications of the more common nutrient elements, i.e. N, P, K, Ca, Mg, were unsuccessful. The application of zinc-contaminated ferrous sulphate gave better results. More than 2,000 trees were treated and 56 tons of ferrous sulphate used. In sandy soils containing very little clay and very little carbonate 15-20 lb. would make a tree nearly normal, 30-40 lb. generally being necessary to correct the condition completely. The more clay and carbonate, the greater was the amount of FeSO_4 required. Surface application was much more effective than through a pipe forced into the soil. The effect of such treatment was not permanent, lapsing usually with the 3rd summer after treatment. CuSO_4 was tried as a remedy in vain. Chemically pure FeSO_4 was also without effect. The application of ZnSO_4 in amounts equivalent to that present as impurity in the FeSO_4 was ineffective, but in larger quantities was quite successful. Trees are now being injected with ZnSO_4 , and are being sprayed with a zinc Bordeaux when in foliage. Since the FeSO_4 used contained also other

impurities such as cobalt, bromine, iodine, chromium, strontium, barium, tin, nickel, boron, and lead, a number of trees are now being treated with chemically pure ZnSO_4 and the effect noted.

241. ANDERSEN, F. G. 632.191 : 634.1/2
Chlorosis of deciduous fruit trees due to a copper deficiency.
J. Pom. Hort. Sci., 1932, 10 : 130-46, bibl. 53.

Chlorosis has previously been attributed to excess of lime, deficiency of iron in an available form, deficiency of manganese, of sulphur compounds, of magnesium, of potassium, of nitrogen and to excess of manganese and of boron. This article from South Africa shows yet another cause. The disease in this case was marked by yellowing of the leaves (not very obvious in apples and pears), rosetting of leaves (not in pears) and dying back of the branches from the tips. It occurred in trees on a light sand or very sandy loam, of good drainage, considerable depth and a pH varying from 5.5—6.5. The land normally is heavily fertilized and carries an annual leguminous cover crop. Soil analysis suggested deficiency of Mn or of Cu as the cause of the trouble. Treatment with K, Mg, Mn, S, Fe, or manure had no effect. Spraying with Bordeaux or a commercial colloidal copper was unsuccessful. The injection of two litres of a dilute CuSO_4 solution (0.3 p.p.m. Cu) into the trunks had no effect. Leaves dipped into CuSO_4 solution of the above strength turned green at the end of two weeks. Applications of CuSO_4 ($\frac{1}{2}$ —2 lb. per tree) to the soil in early winter and digging in resulted in the absence of the chlorotic feature the following summer. Equal success was obtained by injecting the CuSO_4 as a suspension or solution 2—3 ft. into the soil in the early spring by means of the apparatus described by McKinnon and Lilleland (*H.A.*, 1931, 1 : 4 : 347).

242. AUSTIN, M. D., JARY, S. G., AND MARTIN, H. 632.951.4
Studies on the ovicidal action of winter washes, 1931 trials.
J. South-Eastern Agr. Coll., Wye, 1932, No. 30, pp. 63-86, bibl. 8.

The authors remark on the necessity for some degree of standardization, which will enable the fruit grower to be sure of obtaining the same winter wash each year. To make this possible, evidence must be got as to what particular characteristics are responsible for its ovicidal action, so that a definite correlation may be established which will enable the chemical and physical properties of an oil to be interpreted in terms of its biological performance. To find such a correlation is the aim of the experiments on which this article may be regarded as a progress report. Comparisons are made of various petroleum, vegetable and tar oils in general use, their effect on the eggs of such insects as capsid, aphid, apple sucker, winter moth, red spider, pear leaf blister mite. Details are given of analytical methods for examining different kinds of winter washes.

243. JARY, S. G. 632.951.1
Pyrethrum.
J. South-Eastern Agr. Coll., Wye, 1932, No. 30, pp. 183-5.

Data on cropping and harvesting are available from a half-acre plot laid down in 1929 under suitable conditions of soil and locality at Wye. The crop in 1930 was about 6 cwt. including stem, of which $1\frac{1}{2}$ cwt. was flower heads. In 1931 the weight of dried flower heads amounted to 6 cwt. Harvesting had perforce to be done by hand, normally with a sickle or hook or by actual hand picking, where "bindweed" (*Convolvulus* sp.) was very bad. Various methods of separating the heads from the stalks were tried, the most successful being as follows :—a long metal "comb" with sharpened teeth somewhat like a cutter bar was mounted on the side of a hop bin, so that a bunch of flowers after being cut could be pulled through it and the heads collected in a bin. One man cutting the flowers could keep two at work pulling the bunches through the comb, but where "bindweed" was prevalent this method was impracticable. When necessary drying in the hop oast was successful. The experiment continues.

244. STANILAND, L. N., AND WALTON, C. L. 632.754 : 634.11-2.951.8
Field trials of tar distillate—heavy paraffin washes for apple capsid bug (*P. rugicollis*) control. Season 1930-1.
Long Ashton Ann. Rept. for 1931, 1932, pp. 89-100, bibl. 2.

Results in general from trials at six centres were promising and superior to those got with the "high neutral" type, though there was one complete failure in Kent and a partial one in Worcestershire.

245. TUTIN, F. 632.951.8
A note on the toxicity of mineral oil sprays to vegetation.
J. Pom. Hort. Sci., 1932, 10 : 65-70.

The object of the paper is to supply such information as will act as a guide in the selection of an oil suitable for use as a summer spray. Field trials were made with a series of 5 oils prepared in 3, 1.5 and 0.75% concentrations. Results showed that the degree of toxicity of the 5 oils is quite in harmony with their respective "iodine values." Trials were made with emulsions prepared by different methods, and the writer comes to the following conclusions. The "iodine value" (Hüble or Wijs method) can be taken as an index of the toxicity of a "mineral" oil towards vegetation. This "value" appears to be equally reliable and is more readily estimated than the "unsulphonatable residue." It is not safe to use an oil with an "iodine value" greater than 1.0 for the preparation of a summer spray mixture having an oil content of 3%. It is, however, impossible to state positively that every "mineral" oil with an "iodine value" of 1.0 or less can be safely used on growing vegetation. Damage to foliage may result from the use of an unsuitable emulsifier even with a non-toxic oil.

246. BALLANTYNE, J. A., AND CAYZER, L. S. 634.11-2.951.23
Removal of arsenical residue from apples.
Agr. Gaz. New South Wales, 1932, 43 : 459-66.

A progress report on experiments carried out at Bathhurst Experiment Farm, N.S.W. for the removal by simple and inexpensive methods of arsenical spray residues from apples. It was found that by dipping in 2% hydrochloric acid the arsenical residues on apples which have received up to six sprayings of lead arsenate can be reduced to an amount within the world's tolerance limit (1/100 grain of arsenic As_2O_3 per lb. of fresh fruit). The dipping was quite simply and inexpensively done by submerging the fruit, packed in half-bushel cases, in the acid bath and moving the case up and down in the liquid. The case of apples was then placed on a draining board to enable the acid to drain back into the bath. After draining the case was submerged in a tub containing clear running water and again handled with an up and down motion. Next the case and apples were placed on a draining table and sprayed with clean water. The wax formed on apples during storage was found to hinder the solvent action of the acid. Apples should therefore be dipped immediately after harvesting.

247. FISHER, D. F., AND REEVES, E. L. 634.11-2.951.23
Arsenical and other fruit injuries of apples resulting from washing operations.
U.S.D. Agr. tech. bull. 245, 1931, pp. 12, bibl. 11.

The authors conclude that the prevention of injury from soluble arsenic and the various acid and alkali solvents used in washing apples depends primarily on the adequate rinsing of the fruit with clean water. Where this is not available in sufficient amounts, the addition of lime to the rinse water is beneficial. Loss from storage rots may be somewhat greater on washed apples owing to the extra handling to which they are subjected. Careful handling to avoid bruising or puncturing the skin and the use of copious quantities of fresh rinsing water under pressure are important factors in reducing losses from storage rots.

248. ROBINSON, R. H. 634.23-2.951.23
Arsenical spray residue on cherries.

Oregon State Agr. Coll., Agr. Exp. Sta. bull. 298, 1932, pp. 15.

Washing in dilute HCl, followed by adequate rinsing, was found to be most effective for removal of spray residue. Directions are given for adequate treatment, the following precautions being stated. (1) Cherries should stand an hour or two after picking before washing so as to avoid possible cracking by the rinse water. (2) If rain has fallen during the night, let cherries stand three hours after picking to avoid splitting. (3) Replenish acid tank as wanted, using 1 pint strong commercial HCl (20° Baumé) to each 10 gallons of water. For doing this a 3-gallon wooden bucket is convenient. The crate holding the cherries should be painted to prevent the acid soaking into the wood.

249. JANCKE, O., AND LANGE, L. 634.11-2.42
 Ueber die Mehltauanfälligkeit unserer Apfelsorten. (**Mildew susceptibility of German apple varieties.**)
Gartenbauwissenschaft, 1932, 6 : 433-45, bibl. 28.

An account of observations made of the incidence of mildew on particular varieties (1) in different parts of Germany, (2) in different situations in the same district, in the hope of determining the influence of age, method of planting and rootstock. The figures given are interesting and suggestive but do not point to very definite conclusions.

250. OGILVIE, L. 634.75-2.48
Hard rot of strawberry fruits.
Long Ashton Ann. Rept. for 1931, 1932, p. 118, bibl. 1.

The author describes the fungus and illustrates the damage done. It has been provisionally identified as *Septoria Fragariae* Desm.

251. MARSH, R. W., AND WALKER, MARY M. 634.11-2.42
The scab fungus (*Venturia inaequalis*) on apple shoots.
J. Pom. Hort. Sci., 1932, 10 : 71-90, bibl. 27.

The authors have observed and give a detailed account of the full infection cycle from summer to summer on the variety Lord Suffield, of conditions influencing the course of infection and of the dissemination of spores from scabbed shoots on this variety. They then compare scab attack on shoots of certain other varieties, noting that Lane's Prince Albert is generally little subject to scab attack on its shoots, while those of Worcester Pearmain are commonly attacked, and that on Cox's Orange Pippin scabbed wood is of widespread occurrence. The importance of scabbed shoots as potential sources of infection in April and May is shown. The difficulties of killing scab pustules on shoots by direct spraying are discussed.

252. GOODWIN, W., SALMON, E. S., AND WARE, W. M. 634.11-2.42
The control of apple scab on Worcester Pearmain and Allington Pippin ; a three years' experiment.
J. South-Eastern Agr. Coll., Wye, 1932, No. 30, pp. 28-50 ;
 and
The control of apple scab. I. Allington Pippin and Newton Wonder.
Ibidem, pp. 51-62.

The first article is an account of spraying experiments carried out in a commercial orchard for three successive years on a commercial scale. Home-made Bordeaux mixture was found to be a more efficient fungicide on both varieties than lime sulphur. The use of the latter is, however, recommended by the authors for Worcester Pearmain, where a high finish is desired, as Bordeaux causes russetting and discoloration on this variety. Good control was achieved by three annual sprayings, two of them being pre-blossom.

The second article deals with four years' experimental work on scab control on Allington Pippin and Newton Wonder by three annual sprayings with Bordeaux or lime sulphur. Considerably

greater control was obtained with Bordeaux. The experiments will be continued with the aim of achieving even greater control and the production of scab-free apples for sale under the National Mark. As there were indications that the scab fungus obtained a hold on the foliage early in the season, the plots of both varieties will be sprayed during the coming period of 5 years with Bordeaux as before, but a further pre-blossom application will be made at the "mouse ear" stage of growth of the opening buds.

253. RIPPER, W. 632.753 : 632.96
 Eine neue Methode der Kolonisation der Blutlauszehrwepe. (A new method of introducing *Aphelinus mali*.)
Gartenbauwissenschaft, 1932, 6 : 682-90.

An account of a method of raising *Aphelinus mali* for release in suitable weather in northern climates.

254. SILVESTRI, F. 632.96
 The biological control of insect and weed pests.
J. South-Eastern Agr. Coll., Wye, 1932, No. 30, pp. 87-96.

This is a summary by the author of three lectures given by him at the invitation of the University of London in May 1932. In the first he defined the biological method of control as one in which the insect is kept down by means of (a) physiological or virus disease, or (b) vegetable or animal parasite. He then proceeded to a consideration of the best method of classifying and differentiating parasites, and ended by a brief history of this method of control. In his second lecture he discussed the qualities that must be looked for in parasites which are to be used for the control of insect pests, the methods to be employed in the discovery of such parasites and the dangers inherent in their too precipitate introduction. In his last lecture he dealt with the biological control of weeds, sketching the programme which must be followed in attempting this. The article is most stimulating and suggestive.

255. SPRENGEL, L. 632.77 : 634.23
 Biologische u. epidemiologische Untersuchungen als Grundlage für die Bekämpfung der Kirschfruchtfliege (*Rhagoletis cerasi*). (Investigation of the life and epidemic incidence of the cherry fruit fly as a basis for its control.)
Gartenbauwissenschaft, 1932, 6 : 541-53.

Results indicate that the insect should be controlled by contact and stomach sprays in the imago stage, fluorine compounds, nicotine, pyrethrum or derris being suggested.

256. STANILAND, L. N., AND WALTON, C. L. 632.754 : 634.723.1
 The control of Capsid bugs on black currants. Field experiments in 1931.
Long Ashton Ann. Rept. for 1931, 1932, pp. 83-8.

These experiments carried out at two centres in Worcestershire confirm the 1929-30 results reported in the *Journal of the Ministry of Agriculture* for August 1930, and indicate that mixtures of tar oil and heavy paraffin oil, in equal proportions, at 10%, give a practically complete control of capsid bugs on black currants.

257. WALTON, C. L., AND KEARNS, H. G. H. 632.76 : 634.75
 Carabid beetles as strawberry pests in the Cheddar Districts.*
Long Ashton Ann. Rept. for 1931, 1932, pp. 77-82.

Notes on the life-histories, damage and control of certain ground beetles which do damage to strawberries are given. The most serious of them is *Ophonus pubescens* and is called by the authors the Strawberry Seed beetle. Others less important are *Pterostichus madidus* and *P. vulgaris*.

* Reprinted from *Journal of Ministry of Agriculture*, July 1931.

258. KEARNS, H. G. H., AND SWARBRICK, T. 632.793 : 634.11
Some observations on the control of the Apple Sawfly (*Hoplocampa testudinea* Klug.).

Long Ashton Ann. Rept. for 1931, 1932, pp. 112-7, bibl. 1.

Satisfactory control was obtained in trials at Long Ashton on Worcester Pearmain by spraying with a nicotine wash of 8 oz. nicotine to 2½ lb. Agrid I to 100 gallons water at a pressure of 160-180 lbs. per square inch between the 3rd and 8th day after petal fall.

259. MASSEE, A. M. 632.654.2 : 634.1/7
Some injurious and beneficial mites on top and soft fruits.
J. Pom. Hort. Sci., 1932, 10 : 106-29, bibl. 33.

The mites (*Acarina*) are grouped under their respective host plant, some of them, such as the fruit tree red spider (*Oligonychus ulmi*), appearing therefore several times. Facts known as to descriptions and life-histories are recorded. Special reference is made to mites of economic importance, control measures being suggested or recommended where possible. Brief references are made to mites, which as yet only occur abroad but may sometimes be found here. Certain beneficial mites are included in the list.

260. BRITISH COLUMBIA. 632.51
Weeds and their control.
Dept. Agr. B.C. bull. 106, 1932, pp. 54.

This useful bulletin starts with the organization available for weed control in B.C., shows how weeds spread, gives hints on weed control in general and notes some of the chemicals commonly used for their control. It then gives details of some 80 odd weeds, their habits and control.

261. JOHNSON, E. 632.51
The puncture vine in California.
Univ. Calif. Coll. Agr., Agr. Exp. Sta. bull. 528, 1932, pp. 42, bibl. 46.

The presence of *Tribulus terrestris* will add considerably to the work of harvesting such crops as melons, grapes, cotton and others which necessitate hand picking. It has also been known to damage citrus fruits by puncturing them through the sacks used at picking, while stock also suffers from its presence in grazing or hay. The life-history of the weed is given. The following methods are recommended for its control. Treat with Diesel oil to kill the seeds without disturbing the vines. Whenever young plants appear and before the burs form, cut off just below the crown or spray with oil or any cheap chemical weed killer. Encourage sprouting of seeds remaining in the soil by frequent irrigation during the summer. Do not plough burs under.

The following articles are also noted :—

EDWARDS, E. G. **Winter-spraying trials in the West Midlands.** *J. Min. Agr., 1932, 39 : 411-20, bibl. 4.*

MARTIN, H., AND SALMON, E. S. **The fungicidal properties of certain spray-fluids. IX. The fungicidal properties of the products of hydrolysis of sulphur.** *J. Agr. Sci., 1932, 22 : 595-616, bibl. 19.*

OGILVIE, L. **Notes on the rusts of basket willows and their control.** *Long Ashton Ann. Rept. for 1931, 1932, pp. 133-8.*

OGILVIE, L. **Observations on hop diseases in Herefordshire and Worcester-shire with suggestions for their control.** *Long Ashton Ann. Rept. for 1931, 1932, pp. 139-42, bibl. 3.*

SWARBRICK, T., AND THOMPSON, C. R. **Observations upon the incidence of "Reversion" and the control of "Big Bud" in black currants.** *Long Ashton Ann. Rept. for 1931, 1932, pp. 101-11, bibl. 2.*

WORMALD, H. **Bacterial canker as a cause of dieback in plum trees.** *J. Min. Agr., 1932, 39 : 208-17.*

SMALL FRUITS, HOPS, VINES.

262. THOMPSON, C. R. 634.722

The identification of red currant varieties.*Long Ashton Ann. Rept. for 1931, 1932, pp. 28-39, bibl. 9.*

The writer notes the availability of several publications on the classification of red currants. Thus attention is drawn to Thayer's* list of varieties with their grouping and to Amos† recent contribution to the study of varieties and their classification in the nursery bed. He considers, however, that confusion in nomenclature still persists and he here presents in tabular form the differences and similarities among the groups and varieties, using Bunyard's‡ work as a starting point. A key is given to serve as a means of determining to which group any particular currant belongs, whether to the Raby (*R. rubrum*), the Dutch (*R. vulgare*), the Versailles (*R. vulgare macrocarpa*) or to the Gondouin (*R. petraeum*) group, identification being established by the observance of (1) spring characters—flowers; summer characters—foliage and length of petiole; winter and spring characters—colour of wood, etc. Having thereby found the group, the actual variety can then be run down from the description of the varieties given in this paper. Subject to such modifications as may always be necessary in keys of this sort the guide should be extremely useful. The identification characters are very simple and do not demand a knowledge of any but the simplest botanical terms.

263. DARROW, G. W., AND WALDO, G. F. 634.726

The Glennedale gooseberry.*U.S. Dept. Agr., circ. 223, 1932, pp. 4, bibl. 3.*

Notes on the introduction of a variety which appears very suitable for growth in the southern limit of gooseberry growing beyond the reach of the standard varieties. Plants are very vigorous, reaching 6—8 ft. under good conditions on heavy soil at Washington D.C. The foliage is fairly resistant to *Mycosphaerella grossularia*, and is resistant to *Sphaerotheca mors uvae*. It is possibly susceptible to blister rust. It grows readily from cuttings, producing very freely, e.g. 20 quarts under favourable conditions, while on sandy soil nine 5-year-old plants bore an average of 9½ quarts each. Colby reports that it was the only variety in his trials that produced as many seeds from self- as from open-pollination. The berries are purple and make good jam. Owing to size the planting distance apart recommended should vary from 5—7 ft. according to soil conditions.

264. BEARD, F. H. 633.79-1.8 : 581.084.1

Manurial experiments with hops in pot culture.*J. Pom. Hort. Sci., 1932, 10 : 91-105, bibl. 18.*

This is an account of five years' observations on pot cultures from which particular elements were omitted. The omission of nitrogen and phosphorus produced the most marked effects on growth and cropping, the general effect being the same, though somewhat delayed in the case of phosphorus deficiency. Plants were stunted, threw out very few shoots and tended to become quite unable to develop cones. The leaves were pale green where nitrogen had been omitted, dull green in the case of phosphorus omission. These results agree with Wallace's findings on fruit trees. Potassium deficiency did not greatly affect growth, but tended to increase it and to prolong the growing period. The leaves showed the features characteristic of potash deficiency in fruit trees, i.e. marginal leaf scorch, slight chlorosis and purpling. These were much increased

* Thayer, P. "The red and white currants, their history, varieties and classification." *Ohio Agr. Exp. Sta., bull. 371, 1923.*

† Amos, J. "Red currant varieties." *East Malling Research Sta. Ann. Rept., 1928.*

‡ Bunyard, E. A. "A revision of red currants." *J. Pomology, Vol. 2, 1920-21.*

by increasing the supply of nitrogen, thus widening the N/K ratio. The omission of calcium was marked by marginal scorching of the lower leaves, a condition noted by Wallace in calcium starved apple trees. Effects of magnesia deficiency could be seen in typical angular spotting and scorching of the leaves, especially on the older leaves, and are comparable to those obtained with such other plants as tobacco and maize in the United States. Phenomena noted are compared with those observed by other workers with various plants and the possible reasons for their incidence are discussed.

265. WINKLER, A. J. 634.87-1.547.6

Maturity tests for table grapes.

Univ. Calif. Coll. Agr., Agr. Exp. Sta. bull. 529, 1932, pp. 35.

The Balling hydrometer test has hitherto been recommended for gauging the maturity of table grapes, though it has not been found entirely satisfactory in all cases. During the harvest seasons of 1929, 1930 and 1931 more than 3,000 samples of the leading table grape varieties in the ripening range, i.e. from poor to good in eating quality, were scored for eating quality by at least 6 persons. The samples were then pressed and the degree Balling and per cent acidity of the juice obtained. It was found that fruit of the same degree Balling was considerably higher in acidity in certain regions than in others. Hence the sugar content had to be from 1°—2.5° Balling higher than that of two other regions, if the fruit of all three regions was to be of the same relative eating quality. The influence of differences in the seasonal temperatures on palatability was very similar to that of the different regional conditions. In cool seasons the acidity was relatively high in relation to degree Balling and in hot seasons relatively low. Thus in hot seasons the fruit became palatable at a lower degree Balling than in cool seasons. The acidity of the juice is also correlated with the eating quality, but is not alone an index of palatability. By combining degree Balling and per cent acidity of the expressed juice in the form of a Balling-acid ratio an index of maturity was obtained, which embraces the very high correlation of degree Balling and eating quality as well as the condition of fluctuating acidity. It has shown promise as a means for excluding poor fruit without also necessitating a delay in harvesting certain good fruit. A means for determining the maturity by use of the degree Balling and the Balling and acid ratio is discussed.

266. MOOG, M. 634.83

Beiträge zur Ampelographie II. (An ampelographical contribution.)

Gartenbauwissenschaft, 1932, 6: 561-611, bibl. 6.

This completes the author's work on the classification and key to the American vines and hybrids grown at Geisenheim and at Tiefenbach (Lahn). Detailed descriptions are given of seeds, leaves, time of flowering and berries of some 18 Trollinger × Riparia hybrids, and 19 other vines, including hybrids of Gamay, Alicante Bouschet, Riparia, Berlandieri, Riesling and Rupestris, and a key is given by which to identify each one.

267. DANIEL, ESTHER P., AND MUNSELL, H. E. 634.87: 577.16

The vitamin A, B, C and G content of Sultanina (Thompson seedless) and Malaga grapes and two brands of commercial grape juice.

J. Agr. Res., 1932, 44: 59-70, bibl. 14.

Experiments with rats and guinea-pigs showed measurable amounts of vitamin A in both varieties of grape but in neither juice. Vitamin B was present in fair amounts in both grape varieties and in one juice. The Sultanina contained very small amounts of vitamin C, the Malaga even less. There was probably none in either juice. Sultanina contained a minimal amount of vitamin G, while Malaga and the juices were entirely lacking in it.

268. BARNARD, C.

634.87 : 581.144.2

The root system of the sultana.

J. Council Sci. and Indus. Res. (Aust.), 1932, 5 : 88-93, bibl. 2.

The observations were made on the Sultana vine in the Mildura district. The object was to provide information for investigations dealing with methods of cultivation and investigation. The author's summary states : (1) The rooting habit of the Sultana is shallow and widespreading and a considerable overlap of the root systems of adjacent vines planted 11 × 9 occurs, restricting the growth of the individuals. (2) Sub-soiling prior to planting increases the depth at which the main roots normally develop, though neither subsequent drainage nor irrigation has much effect in this respect. The depth of penetration of smaller roots, however, is controlled by drainage. (3) Root pruning occasioned by winter ploughing to a depth of 9—10 cm. is beneficial. (4) The feeding roots are annual structures, invariably associated with an epiphytic mycorrhiza, and are developed at a depth of 5—10 inches at the base of the cultivation zone. (5) The root-growth commences about five weeks after the rise of the sap begins and three weeks after bud burst. (6) The great mass of feeding roots presented by the end of November are borne on new extension growth, which has arisen from the ascending laterals decapitated during winter ploughing.

VEGETABLE GROWING.

269. VOGEL, F., AND WEBER, E.

635.63-1.8

Untersuchungen über Umfang und Verlauf der Nährstoffaufnahme, Substanzbildung und Stoffwanderung bei Treibgurke. (**Nutrient intake, body formation and disposal of nutrients in cucumbers grown under glass.**)

Gartenbauwissenschaft, 1932, 6 : 478-99, bibl. 26.

The results, which are given in tables, graphs and diagrams, are based on measurements and weights taken at different times from morphologically similar plants of the "Spot Resisting" variety of cucumber and should, in the opinion of the authors, form an excellent basis for a closer determination of the manurial requirements of the cucumber. They find that potash are considerably greater than nitrogen requirements. The need for potash, moreover, becomes increasingly greater while growth continues, while the maximum demand for nitrogen occurs from the 31st to the 44th day, for phosphates from the 45th to the 58th day and for lime from the 17th to the 44th day. These facts should, they consider, have considerable weight in determining what fertilizers to use.

270. SECRETT, F. A., AND BEWLEY, W. F.

635.5

Cultivation of early and late salad crops for market purposes. Methods and varieties.

Royal Horticultural Society occasional publication, 1932, pp. 8, price 3d.

This is primarily intended to encourage and facilitate the growing and marketing in England of salad crops out of season. Useful notes are given on the cultivation of lettuce as follows : (1) growing in the open for marketing from October to December and from April to May ; (2) growing in cold frames or under bell glasses for sale from the end of March to the end of April ; (3) growing under glass (a) in heated houses devoted solely to this crop, (b) as a catch crop between tomatoes. Similar advice is also given on the production of endive, corn salad, radishes and chicory.

271. JONES, H. A. 635.1

Spacing studies with asparagus.

Univ. Calif. Coll. Agr., Agr. Exp. Sta., bull. 525, 1932, pp. 13.

and,

Spacing studies with male and female asparagus plants. [In English.]

Gartenbauwissenschaft, 1932, 6: 465-77, bibl. 5.

These articles give an account of trials started in 1924 at Davis, California, with the Palmetto variety and still continuing.

The distance between the rows was $7\frac{1}{2}$ ft. and the different spacings between crowns were in duplicate. All asparagus was cut green. The soil is a silt loam. Surface irrigation was done when necessary during the summer. The time of the first irrigation varied with the amount of winter rainfall. A heavy irrigation was given immediately after the cutting season, while the last was generally made about the first of September. The tests were made with plants of both sexes, the data on the differences between them being given only in the second paper. The writer's experiments over a seven-year period with 12, 18, 30 and 36 inch spacings showed that plants spaced about 18" apart in the row gave the best results. The 18" spacing was superior to the 12" spacing in size of spear and superior to the wider spacings in yield per acre. The plants at the 18" spacing have maintained the yield per acre of the closer spacing and the average size per spear of the wider spacings. As regards differences in production of male and female crowns the male crowns were found to produce more spears and more stalks (i.e. the spears produced after harvesting) than the females at all spacings, the average size of the female spear and stalk being always larger than that of the male. At all spacings the male crowns outyielded the females in spear production. At similar spacings the two sexes produced about the same weight of stalks per acre.

272. SCHNEIDER, E. 635.1-1.8

Ueber den Einfluss der Düngung mit verschiedenen Stickstoffformen auf das Wachstum und den Ertrag einiger Gemüsearten. (The effect of different nitrogenous fertilizers on the growth and cropping of certain vegetables.)

Gartenbauwissenschaft, 1932, 6: 500-18, bibl. 14.

The experiments were carried out on a very uniform, loamy sand field (size not stated), poor in humus, in which the addition of K_2O or P_2O_5 usually has little effect, that of nitrogen considerable. The field had carried roots in 1927, oats in 1928 and summer barley in 1929 and 1930. A certain amount of artificials was given during this period, and previous to the vegetable trials the whole field received a uniform dressing of well-rotted manure. It was then divided into 16 plots and the following treatments carried out in quadruplicate:

K (approx. 160 lbs. per acre K_2O , as potash salts) + P (66.75 lbs. per acre P_2O_5 , as supers); K + P + N (178 lbs. per acre N, as calcium nitrate); K + P + N (178 lb. per acre N, as ammonium sulphate); K + P + N in same amounts as Nitrophoska. Trials were made with lettuces, radishes, beans, celery, red cabbage and spinach. Crops produced were of very good quality in all except the nitrogen "deficient" plots. Nitrophoska gave the best results with all vegetables, while ammonium sulphate proved better than calcium nitrate on celery and red cabbage, but inferior on lettuce, radishes and beans. The content of the different vegetables in reducing sugars varied greatly according to the absence or the type of nitrogen fertilizer used. Where nitrogen was absent lack of sugar was evident to the taste. Sugar content was greatest when Nitrophoska was used, and greater after calcium nitrate than after ammonium sulphate.

273. OGILVIE, L., and MULLIGAN, B. O. 635.1/5-2.3/4

Progress report on vegetable diseases. III.

Long Ashton Ann. Rept. for 1931, 1932, pp. 119-32, bibl. 9.

Diseases discussed here are: of Asparagus:—violet root rot (*Rhizoctonia crocorum*? = *Helicobasidium purpureum*) and *Zopfia rhizophila*; of dwarf beans:—*Bacterium Medicaginis*. var.

phaseolicola, dry root rot (*Fusarium martii* var. *Phaseoli*) and anthracnose (*Colletotrichum Lindemuthianum*); of leeks:—white tip disease (*Phytophthora Porri*), *Botrytis* sp., Leek rust (*Puccinia Porri*); of lettuce:—stem rot, leaf spot (*Pleospora herbarum*); and ring spot (*Marssonina panattoniana*); of mint:—rust (*Puccinia Menthae*); of onions:—*Botrytis* sp.; of parsnips:—parsnip “canker” and *Sclerotinia sclerotiorum*, the latter on stored roots; of peas:—foot rots *Fusarium* and the eelworm *Heterodera Schachtii*; leaf and pod spots (*Aschochyta* sp.), mosaic; of potatoes:—potato “sickness,” a diseased condition associated with *Heterodera Schachtii*, *Corticium (Rhizoctonia) Solani*, and often *Colletotrichum atramentarium*; of vegetable marrows:—mosaic.

The following article is noted:—

WRIGHT, R. C. AND OTHERS. **Effect of various temperatures on the storage and ripening of tomatoes.** *U.S.D. Agr. tech. bull.* 268, 1931, pp. 34, bibl. 8.

FLOWER GROWING.

274. CAYLEY, DOROTHY M.

635.944-2.8

“Breaking” in tulips. I. and II.

Ann. Appl. Biol. 1928, 15 : 529-39, bibl. 6 and *ibidem*, 1932, 19 : 153-72, bibl. 15.

In the first article the author showed that “breaking” is infectious and can be induced by bringing the internal tissue of a normal bulb into contact with tissue from a “broken” bulb during the resting stage. The degree of “breaking” appeared to be proportional to the amount of infected tissue introduced, the bulbs plugged with small plugs of “broken” tissue showing only slight but quite definite “breaks,” while much heavier “breaking” occurred when two bulbs, one “broken” and the other not, were cut vertically so as to leave the growing points intact, the halves of each bulb being tied together. Injections with nitrate gave negative results in both sets of trials. Attempts to induce parrotting by grafting were unsuccessful. The second set of experiments confirmed previous results as to the infectious nature of the agent or virus responsible. The transmitter bulbs varied in potency of transmission on different host bulbs. “Breaking” was induced in *Tulipa* species, which have been observed to break naturally in the garden, by grafting with “broken” garden varieties. The effect of the virus on the colour plastids and on the distribution of the anthocyanin sap pigment is discussed in the second article.

CITRUS.

275. TOXOPEUS, H. J.

634.3-1.541.11 : 581.141

Selectie van onderstammen uit zaaisels van Japansche citroen en van citronella. (Selection of rootstocks from seedlings of “Japansche citroen” and rough lemon.) [Dutch—10 line English summary.]

Landbouw, 1932, 7 : 843-50, bibl. 1.

It is possible by distinguishing the seedlings of sexual from those of vegetative origin in “Japansche citroen” (*C. hybrida*)* and rough lemon to make use of the vegetative ones alone as rootstocks and so ensure a more or less standardized stock; an advantage, since the rootstock of citrus, it is here alleged, has a great influence on the scion. In rough lemon the seedlings of

* Said by Oehse to be a cross between a so-called sour Japanese mandarin (*C. nobilis* Lour. var.) and *C. Limonia* Osbeck.

vegetative and sexual origin are so distinct that it is unnecessary to describe them, quite apart from the fact that the sexual seedlings are generally weakly. There are two or three embryos produced per seed and, as these obstruct each other's development, it is necessary to separate them as soon as possible, which should be done as soon as the second leaf is formed. In "Japansche citroen" there is more chance of confusing the two types, though the distinction is simple enough to anyone familiar with the plant. A table is given setting out the differences between the vegetative and sexually produced seedlings and is supported by photographic illustrations. In "Japansche citroen" there is usually only one plant per seed, but if there are two, one is often of generative descent and is usually a weak grower. If both are of vegetative origin they do not in this plant incommode one another and hence there is no such need to separate the twin seedlings as is the case with rough lemon. [Full translation available.]

276. BLATT, R. J.
Organic fertilizers in relation to citrus culture.
South African Fruit Grower, 1932, 19 : 119-21.

634.31-1.8

With a view to their application to South African conditions the author considers the results of certain manurial experiments on citrus conducted by the Riverside Citrus Experiment Station, Calif. A 50-acre grove of carefully selected citrus (the varieties not being here stated) was planted in 1917 and until 1927 received uniform treatment throughout. Winter cover crops were grown annually in addition to summer cover crops during the first 6 years. There are 46 regular fertilizer treatments replicated 4 times, the 4 plots in each treatment being so arranged that the average yields for the 6-year period 1922-7 were the same, thus ensuring an equal start from the standpoint of yield. An outstanding feature of the trials so far is the great deterioration even after 3 years of the trees which are not receiving organic matter. In the case of trees receiving nitrogen and no organic matter the deterioration is still worse. With the knowledge gained so far it is considered that South African growers would do well to concentrate on the application of nitrogen and organic matter to their citrus trees, this method giving excellent results in California. The nitrogen should be applied in such quantities and at such times that adequate nitrates are available for tree use at all times, especially during summer and early autumn, 2 lb. per tree per annum being the required total amount. Organic manure may be applied at any time, but usually in the autumn, leguminous cover crops, providing there is plenty of moisture in the soil, being most beneficial. Cotton seed meal has proved one of the cheapest fertilizers to give satisfactory results.

277. NAIK, K. C.
A study of orange marketing in England with special reference to the possibilities of marketing Punjab oranges.
Agric. and Live Stock in India, 1932, 2 : 130-56, bibl. 14.

634.31 : 658.8

The systems of marketing in force at the various English markets are described. A discussion of the qualities, quantities and times of export of oranges to England from the exporting countries of the world follows. Considering the possibilities of a successful entry of Punjab oranges into the English market it is noted that, since the season for Punjab oranges ranges from November to March, their competitors in England would be Spain and Palestine. The only orange at present available for export in quantity from the Punjab is the "Malta" orange. Experienced brokers have expressed the opinion that this would stand competition with any other orange entering England at the same season. The high cost of transport, however, in comparison with that paid by other countries, is a very serious obstacle to the development of an industry, as is the absence of proper refrigerating facilities. Neither of these obstacles is likely to be removed until the growers can be brought to follow the example of growers in other citrus producing countries, and co-operate.

278. HALMA, F. F. 634.337-1.541.6
An attempt to recover declined lemon trees by use of inarching.
Calif. Citrograph, 1932, 17 : 349, 365-7.

The gradual deterioration of lemons on sour stock at about 10—14 years of age led to a series of experiments whereby declining lemon trees were inarched above the bud union with seedling stocks of eleven different citrus varieties, 3 stocks being used for each lemon tree. The experiment was begun in July 1926; after 3 years, 5 comparable trees, each inarched with a different variety, were completely girdled below the bud union and the cambium removed leaving the trees entirely dependent on the new rootstock. In every case the leaves turned yellow and the trees had to be severely pruned. Two years later the trees inarched to rough lemon and grapefruit had recovered and showed a fair amount of healthy new growth. The trees inarched to sweet orange and Dancy tangerine recovered to a lesser extent and the tree on Brazilian sour orange died. The true condition of the trees, however, will not appear for some time, the present new growth being the result of pruning. With the other inarched trees, not girdled, there has been little change, the good trees of 1926 remaining good and the inferior ones inferior. New lemon trees on sour orange planted when the experiments began in 1926 are already yielding more than the declining inarched trees. The results show that inarching cannot be recommended for decline in lemons on sour stock and raise the question whether this decline is due to sour stock influence at all. Progeny tests of good and declined trees showed a decided bias in favour of the progeny of good trees and indicate that the scion variety may have a distinct bearing on the early decline of lemon trees.

279. WINSTON, J. R., AND LUTZ, J. M. 634.3-1.547.6 : 547.313.2
Recent developments in citrus coloring.
Proc. Amer. Soc. Hort. Sci., 1931, 28 : 45-8.

This is a summary of results of recent investigations on factors influencing the rate of colouring and subsequent keeping quality of citrus fruit, together with the authors' deductions, which include the following: The fruit should be brought to the optimum colouring range quickly, which is best done by holding the air temperature at 95° until the fruit reaches 85°, after which the air temperature should be kept at 85—87°, the best temperature which does not at the same time endanger the fruit. Adequate ventilation should be available, one good method being the provision of a vent on the suction side of the blower, which permits the introduction of outside air. A relative humidity of from 80 to 92 seems to be the most desirable. Ethylene given on the "trickle" system, whereby a small constant supply of ethylene is continuously introduced into the room, has been found to be the most successful. By improved methods in Florida it now rarely takes longer than 60 hours to colour green oranges early in the season, or 36 hours later in the season.

TROPICAL CROPS.

280. OPSOMER, J. E. 633.513
La culture du Kapokier à Java. (The cultivation of kapok in Java.)
Bulletin Agricole du Congo Belge, 1932, 23 : 3-53, and 166-204, bibl. 142.

The author of this report visited Java for the purpose of studying the subject. The first systematic attempts in Java to improve the existing varieties of kapok were undertaken in 1928, although in 1916 a collection of varieties was assembled and in 1923 the first buddings or graftings were made. In 1928 investigations were divided into two parts. Investigations on behalf of the native cultivator were dealt with by the General Experiment Station in collaboration with the Agricultural Advice Service, while those on culture by Europeans were assigned to the Government Rubber Plantation Service. The report opens with a botanical description of the varieties of most promise, *Ceiba pentandra* var. *indica* found in East Indies, Philippines; *C.p.* var. *caribaea* America, Africa; *C. trischistandra* Peru; *C. aesculifolia* Mexico. Authorities differ as to the

most suitable soil, which is taken as evidence that *Ceiba* is not difficult to please. Soils to avoid, however, are those of little depth, overlying rock or heavy clay, or heavy clay soils with a high water table. The most suitable climatic conditions are tropical, with a dry season lasting from the opening of the flowers to the ripening of the fruit, a period of about 3 months. Without this dry period the fruit may rot and the kapok will be of inferior quality. Propagation by seed is from selected varieties. Fresh seed has a germinative capacity of 95%. Old seed should be first tested by placing in water. After 24 hours the good seed will have sunk to the bottom, the bad be still floating on the surface. Seed can be sent long distances, if first dried in the sun and placed while still hot in airtight receptacles, which have also been heated in the sun. Vegetative propagation is easily effected by budding in the nursery, using either a modified form of the Forkert method* or a simple patch bud. The age of the stock is from 6 months to a year. Phases in the life of the tree are: planting out at 1 year; first crop 4 years after planting, sometimes earlier; in full bearing at 14—15 years, though growth continues. The productive life of the tree is about 70 years. Flowering begins in Java at the beginning of the dry season in May, a second and possibly third blooming taking place two to three weeks later. Although flowers are always abundant, only a small proportion of fruit reaches maturity. Heavy rain and a heavy natural drop account for the rest. Among the natives, where kapok is generally grown in mixed cultivation, propagation was until recently effected by cuttings, which were often stumps or truncated branches, in which case the cut tops would be protected from rot by a covering of banana leaves. Preliminary investigations with a view to improving production of kapok have elicited the following facts. The tree is probably to a large extent self-fertilized and is as a general rule homozygous. The individual flower lasts but a few hours: opening at 5 o'clock in the afternoon it begins to close at 8 the following morning, is completely closed at midday and has fallen by 7 o'clock that evening. Research into improvement of native planting is directed towards seed selection from trees showing some particularly advantageous characteristic, such as high percentage of fibre, large fruits, indehiscent fruits, precocity in flowering or maturation. In the European section buddings and sowings from the same selected trees are compared. Seed selection is being continued from trees of known capacity. It is suggested that trees might be found and propagated of which the whole process of fruit ripening occupies only a short time, since this would lead to economy in picking and to the possibility of planting quick ripening varieties to fruit in succession.

281. MANN, H. H.

633.72(47)

The recent tea developments in Georgia.*Indian Tea Assoc. Q. J.* 1932, part 2, pp. 55-69.

Under the U.S.S.R. agricultural schemes the tea plantations of W. Georgia have been extended from 2,000 acres in 1926 to 55,000 acres at the present time. Climatic conditions in Georgia are not entirely favourable to tea cultivation, though during the height of the season, June to September, strong and vigorous flushes can be obtained. Compared with the tea soils of N.E. India the soils of W. Georgia are on the whole poorer and overlies a heavier subsoil. This introduces difficulties with regard to drainage and root development which are countered by deep cultivation. The difference between the development of the plants where the subsoil has been loosened and those where it has not is stated by the author, who has studied the conditions on the spot, to be very remarkable indeed. Owing to shortage of labour mechanical methods of cultivation are being tried wherever possible. An efficient petrol motor cultivator made by Siemens Schuchert of Germany is already in use. It will cultivate $2\frac{1}{2}$ acres per 8-hour day with a consumption of $1\frac{1}{2}$ galls. Hand-hoeing still has to be done among the plants in the rows, but 75% of the land can be cultivated mechanically. The site is prepared wherever possible by heavy tractors, ploughs and subsoilers. A mechanical plucker has been devised, and, since mechanical plucking must always at its best produce much broken leaf, a pneumatic method of separating the cut leaves and tips from the properly plucked shoots has been invented and is in use at the

* A form of budding in which the loosened bark of the stock is peeled down—not cut off—and left in the form of a flap. One half to two-thirds of this flap are removed and the remainder is tied over the bud.

important new Chakwa factory. However, much of the tea growing is at present in the hands of peasants under a system of collective holdings, the pluckings being handled at small factories dotted about the tea areas, and here the more primitive methods of cultivation are still in use. The factories of recent erection are of very good design and equipped with the latest machinery. The Russians are bringing every scientific and mechanical aid to bear in the perfection of their tea industry and the author considers that in a few years they will produce developments, particularly in mechanization, which have hardly occurred to workers hitherto. Great attention is being paid to the building up of strains suitable for Georgian conditions, particularly in the matter of cold resistance combined with productivity, and, as a corollary, to vegetative propagation on a commercial scale. The prevention of erosion with the minimum of labour is also being carefully studied. As regards present quality of Georgian tea London market opinion considers it to be of a very ordinary type. What will be the future importance of Georgian tea cultivation to the tea industries of other countries remains to be seen, but owing to the limitations of soil and climate it is not considered likely that even a maximum of success will enable Georgia ever to supply the demand of the Russian people themselves. The author thinks that the growing prosperity of Russia will enable local production to be assimilated without lessening the present Russian demand for foreign teas.

282. TUBBS, F. R. 633.72-1.531

The germination of tea seed.

Tea Quarterly, 1932, 5: 66-8, bibl. 1.

The seed of tea consists of 2 cotyledons enclosed by a thin papery integument and a thick woody shell. In germination tests it was found that the removal of the seed coat led to a more rapid absorption of water than in the unopened seeds. In germination tests of shelled and unshelled seed it was found that an increased germination and growth resulted from the removal of the shell, the growth differences being discernible in leaf, root and stem. At the time of the abscission of the cotyledons, however (5 months in the case of shelled and 6 months in unshelled), when new growth is dependent on a supply of energy from the green leaves alone, there is a slowing down in the growth of the shelled seedlings. For turning the results of these investigations to practical account Gadd's* suggestion is quoted, that the seed be cracked only, since the removal of the entire seed coat needs considerable care and destroys the protective covering. Cracking has been found to be an adequate method of allowing the necessary easy access of water and oxygen to the embryo.

283. MAYNE, W. W. 633.73(58) (058)

Annual Report of the coffee scientific officer, 1930-31.

Mysore Coffee Exp. Sta. bull. 5, 1931, pp. 24.

Pollen germination. Fresh pollen from Kent's Arabica will give 40-50% germination in artificial culture. This is somewhat increased by the addition of small fragments of stigma, provided they come from different flowers to the pollen. Pollen from early flowers forced into bloom by watering gave a lower germination than pollen collected during the general blossoming. Healthy pollen stored in a dry atmosphere could be kept at least four days without loss of viability. **Fertilization.** Material has been preserved for studying the time required to effect fertilization. It will be dealt with as opportunity offers. **Coffee root systems.** Comparison of Arabica and Robusta root systems showed the much greater development of the latter. A progress report is also presented on investigations into coffee die back, brown root disease and leaf disease.

284. EADY, G. H. 633.74-1.535/54

Vegetative reproduction in cacao.

Year Book of the Dept. Agr. Gold Coast for 1930, also repr. in *Trop. Agriculturist*, 1932, 78: 296-9.

Opening with a general discussion of the advantages of vegetative propagation, the article continues with a report on the methods for so propagating cacao which have been recently the

* Gadd, C. H. *Tea Res. Inst. bull.* No. 3, 1928, p. 16.

subject of experiment by the Division of Horticulture, Gold Coast. Cuttings taken from all parts of the tree, planted in many different rooting media, shaded or exposed to the sun, or previously stratified in damp sand, have all failed to root or even to callus. [Soft wood cuttings have recently been made to root in a solar propagator by E. E. Pyke at The Imperial College of Tropical Agriculture, Trinidad, see *H.A.*, 1931, 1 : 4 : 392 or *Trop. Agriculture* 1931, 8 : 249.—ED.] Out of many hundreds of attempts a few plants have been produced by layering branches. The poor results are thought to be due to the difficulty of preventing movement of the pegged down branches. Inarching on the pot grown seedling stock would have been fairly successful but for local difficulties such as the destruction of the bamboo pots by white ants. An objection made to this method is that the junction has to be high on the stock, whereas cacao often fruits on the main stem at ground level. Marcotting or "gootee" layering is practicable, if only a few plants are needed. Root-wiring consists of twisting a piece of strong wire round a lateral root close to the collar. Many plants so treated produce aerial growth from the wired section, which may then be cut off and treated as a separate plant. At Alburí the lateral roots so treated died almost immediately. Only two produced plants, which died soon after they were planted out. All methods of grafting failed. Many methods of budding were tried without much success until the system of H budding was devised which materially improved the results. An H-shaped cut is made, the longitudinal side cuts being $3\frac{1}{2}$ —4 in. in length. The distance between the cuts varies with the size of the stocks, but should not exceed half the diameter. The bud is inserted at the cross bar of the H, the two flaps so formed being raised for the purpose. Tying is done with any suitable material and the edges of the wounds painted with hot paraffin wax. Buds should be taken from wood 3—5 years old, those from younger wood being unsatisfactory. The operation should be performed when marked flushes of growth occur; the buds must be forced into slight growth by heading back the branches.

285. CHEESMAN, E. E.

633.74

The economic botany of cacao.*Supplement to Tropical Agriculture*, June 1932, pp. 16, bibl. 51, price 1s.

As the sub-title states this is a "critical survey of the literature to the end of 1930." A description of the genus *Theobroma* is given. It is impossible to assign cacao as now cultivated to any existing species, but it falls into two main types, Criollo and Forastero, each of which is again subdivided. The essential distinguishing character between the two types is that Forastero and its hybrids have violet pigmentation in the cotyledons, as seen in the cross-sectioned bean, while Criollo, as long as it is uncontaminated with genetic admixture of Forastero or a violet-seeded type, has white cotyledons. Criollo itself, no longer grown owing to its susceptibility to canker and its generally delicate constitution, has always been associated with quality in the past, and it is beyond doubt that the higher class Forasteros owe their quality to Criollo ancestors and that the greater the admixture of Criollo the higher the quality. There follows a discussion of the origin and ancestry of the cacaos which are grown commercially in different parts of the world. Under the "Life history and morphology" section, the unusual branch habit of the cacao plant is described. Growing from the seed at the height of 3—5 ft. from the ground the straight main stem forks into several almost horizontal limbs, dividing the terminal bud so that no leader remains. This is supplied at a later stage by a vertical shoot ("chupon"), which rises from the main stem just below the fan of branches, grows strongly upwards, and then itself breaks into a fan of horizontal branches or "jorquette." Thus a tree left to itself may produce 3 or 4 tiers, the stem of each rising in similar manner from the one below. The leaves persist through two flushes and drop at the time of the third. This change of leaf is an important physiological crisis in the periodicity of the tree, which has as yet received little attention. There is no literature on the subject of the roots of cacao other than generalizations. The structure of the flower is described. Flowers are produced in great numbers and are not adapted for either self-pollination or by wind or the larger insects. Pollination is effected mainly through the agency of small crawling insects, chiefly ants and aphides. Harland is quoted as having found that under normal plantation conditions only about 5% of stigmas ever received pollen, but owing to the large number of flowers produced even this represented more fruits than the tree

could ripen. The development of the embryo zone is normal. The fruit attains its maximum development in five months. The ripe pod contains from 20—40 seeds. There is great variation in yield, not only in number of pods but also in the actual amount of cacao produced per pod by different trees. The possibility of propagating by budding or grafting only the high-yielding trees is complicated by the fact that there is no guarantee that a high-yielding tree will transmit these qualities to its offspring budded on seedling stocks, which are the only kind available. At present the most certain method of propagation of high yielders is by sowing the seed of the selected tree. It is obviously desirable to control the fertilization to preclude the possibility of pollination by adjacent poor yielders. Either self- or cross-fertilization may be arranged, and on general genetic principles it is probable that the crossing of two high yielders would produce better results than the self-fertilization of one. An experimental demonstration to prove or disprove this is much needed. To establish efficient vegetative propagation some method, commercially practicable, must be found for establishing cacao on its own roots, and thus eliminating the seedling rootstock. As regards environment and its effects on yield, nothing less than the study of the whole life of the plant and its method of building up its crop is needed. It is recognized by many writers (named) that there is a correlation between rainfall and the yield of cacao, though their correlations have not all been consistent. Evidence has been produced by Hewison in Gold Coast Dept. Agr. Year Book, 1928 (bull. 16, 1929) of correlation between the number of pods required to produce a pound of dry cacao taken monthly throughout the year and the rainfall four months earlier; low yield is seldom caused by failure to blossom; more usual causes are failure to set and failure to mature. Dealing first with failure to mature, the recent work of Rounce and Smart in Trinidad and Hewison and Abadio on the Gold Coast is discussed. These workers investigated the shrivelling of the "cherelles" (the Trinidad name for the young fruits) and concluded that internal factors rather than outside conditions are an essential part of the whole process. Shy-setting is attributed to four possible causes:—(1) failure of pollination, (2) structural sterility, (3) functional sterility, (4) nutrition. The author puts forward as a working hypothesis:—"It is not impossible that imperfect fertilization, whether due to structural or to functional sterility, may in some cases completely prevent fruit setting, but in others, so long as the sterility is only partial, may allow the setting of fruits doomed from the start to incomplete development . . . should it prove correct, the further possibility would be opened up that, allowance having been made for such cherelles, any balance of unexplained shrivelling could be more clearly connected with the nutritional or water relations of the tree." The ultimate aim of the geneticist is to combine high quality with high yield. Material for selection is already to hand, and this probably without recourse to artificial hybridization, in the genetic forms classed as Trinitario, a group of extraordinary complexity, which supplies about 20% of the world output. To this group the whole of the Trinidad cacao can be assigned. The effect of environment on quality cannot be gauged until clonal material is available for study, and even then it will be difficult. Since in preparation different cacaos require different periods for optimum fermentation, it is obvious that the fermentation period allowed for the present crops drawn from a mixed population can be only a compromise. Clonal stock would enable a decision to be made as to the period which would best suit the entire crop, and it would ensure uniformity of ripeness at picking time, since all pods would be of one colour according to degree of maturity instead of, as now, each tree having its own characteristic colour which indicates ripeness.

286. LAMONT, N.

633.74 + 634.61 (54.8)

Impressions of a West Indian planter in Ceylon.*Trop. Agriculture*, 1932, 9 : 156-62.

In this paper Sir Norman Lamont gives his impressions of the methods and conditions of the cultivation of certain crops in Ceylon and compares them with those obtaining in Trinidad. The crops common to the two countries are cacao and coconuts. The author disposes of the belief that the high price obtained by Ceylon cacao is due to its being of pure Criollo strain. He says that the hardier and more prolific Forastero cocoa originally imported from Trinidad has gradually displaced it. A comparison of the conditions in the two islands as regards the

cocoa industry shows that the Ceylon plants harvest about 300 lb. to the acre against Trinidad's 255 lb. Ceylon labour costs 9d. a day against Trinidad's cost of 1s. 6d. Taxation in Ceylon is £1 10s. 0d. per head—Trinidad £4 10s. 0d. per head. Ceylon cocoa sells for £77 per ton against Trinidad's £52 based on the average for the whole crop of 1929 in both countries. Sir Norman Lamont explains the survival of the Trinidad industry under four such handicaps as being due to its greater economy in the use of labour (1 man to 5 acres instead of 1 man to 2 acres as in Ceylon) and to labour-saving methods in curing, and remarks that "without the labour-economy of her sliding-roofs the cacao industry of Trinidad would perish in a season." Comparing the coconut cultivation of the two countries the author states that in Trinidad it is confined to two cutlassings of the undergrowth each year, while in Ceylon everything possible is done to encourage growth. There the ground for 6 ft. round the tree is forked twice a year during early years; later the ground is either kept completely clear by ploughing and harrowing, or it is cover cropped, or, if cover crops will not grow on the poorer sands, the soil is manured with pen manure, kainit and wood ash buried in trenches between alternate rows, or a system of radial trenching is used, whereby the ground is divided into 8 trenches radiating from a circumference $4\frac{1}{2}$ ft. from the tree trunk. Two opposite trenches are forked and filled with manure in each of four successive years, so that only a quarter of the tree's surface root system is liable to damage at any one time. The results of this are said to be shown in greatly increased yields.

287. POTTER, T. I.

633.81

The Tonca bean tree.*Proc. Agr. Soc. Trinidad and Tobago*, 1932, 32 : 167-71.

This tree, botanically known as *Dipteryx odorata* or *Coumarana odorata* (*Leguminosae*), provides from its bean an essential oil containing coumarin, one of the bases used in the manufacture of perfumes. It is a native of Venezuela and the Guianas. The tree is cultivated on a small scale in Trinidad. The price fluctuates, that obtaining at the moment, 3s.—4s. per lb., being considered sufficiently remunerative to warrant an extension of plantings. Though usually grown from seed, when the trees take from seven to fifteen years to come into bearing, it has been stated that the budding or grafting of selected scions on seedling stocks will reduce the period to 3 years, as well as increase yield. When there is no other cultivation, the number of trees per acre should be about 50, but, as the trees make admirable windbreaks for other produce, it is suggested that they would be most economically used by being so planted as to serve this purpose in addition to their crop production. The Tonca bean is not particular as to soil, has a long tap root and withstands drought well. In Trinidad it has been planted with success on ground formerly considered unfit for cultivation. If it has a preference, it is for a sandy loam. The average yield of a full grown tree is about 10 lb. of beans. The bean is prepared for the trade by maceration in strong rum in casks for a few days. The rum is then run off and the beans dried and packed for export, the United States forming the principal market.

288. MORRIS, L. E.

633.912-1.541.5

Budding of rubber trees. The position in 1931.*Malayan Agr. J.*, 1932, 20 : 213-9, bibl. 8.

A report is made of the yields of various prominent Malayan clones, both of local and Javan origin. Systems of planting budded rubber as discussed by Mann (*H.A.*, 1931, 1 : 3 : 399) are briefly alluded to. Many new clones have been established for trial. At present there is a choice of over 10 clones yielding 20 lb. or more per tree. Certain clones are more susceptible than others to various troubles. For instance Avros 80 is liable to "pink disease," Avros 152 is attractive to grasshoppers above other clones. In Malaya, though there is no such report from Java, Avros 36 is peculiarly liable to wind damage. The technique of budding older stocks (often necessary through companies making late decisions to bud) is briefly dealt with. When the bark refuses to strip well low on these older stocks, high budding can be resorted to without diminution of future yield. A reference is made to Bobilioff's paper on high budding supporting this statement (*H.A.*, 1932, 2 : 1 : 79). Although the variability of a clone is considerably less than for seedlings, nevertheless a clone is still far from uniform, the coefficient of variability

of the yield being about 25% of the mean. There is close correlation between girth and yield within a clone; with the Pilmoor clones the correlation is so close that a rogue was discovered from its unusual position in the correlation table. Thus in clonal plantings the smallest trees can be removed with certainty as being the poorest yielders. The vigour of a stock closely influences the vigour of a budding.

289. GEORGI, C. D. V., AND OTHERS.

633.912-1.531.16

Storage of rubber seeds.

Malayan Agr. J., 1932, 20: 164-76.

This article summarizes the results of investigations carried out over the past two years to determine the treatment to which rubber seeds should be subjected in order to preserve them during a period of storage rendered necessary by the seasonal nature of the harvest. Rubber seed oil possesses drying properties which, though inferior to those of linseed oil, could still be profitably employed in various ways, while the cake after the expression of the oil forms a valuable cattle food. In the experiments sterilization of the kernels with steam at a pressure of 30 lb. per sq. in. for 15 minutes, followed by 1 day's air drying before placing in sacks and storing for 2 months, did not prevent the subsequent rapid development of acidity in the oil, though this was reduced from 26.8% (calculated as oleic acid) in the untreated controls to 17.9% in the sterilized kernels. In a second experiment the kernels were subjected to the same form of steam sterilization as in the first, but this lasted for 30 minutes, after which they were sun-dried for one week before storage. In this case the kernels remained with a low oil acidity, 3.3%, after storage up to 4 months, but after that period there was a rapid increase to 21.2% at 6 months. Further experiments indicated that with kernels stored under conditions that did not admit of an increase of humidity the oil showed no tendency to develop activity. The characteristics of rubber seed oil are examined and the constants tabulated and compared with those for linseed oil. Rubber seed kernel meal is analysed and compared with linseed meal.

290. PARSONS, T. H.

634.3/8 (54.8)

The cultivation of fruits in Ceylon, with cultural details. I. and II.

Trop. Agriculturist, 1932, 78: 337-42, and 79: 19-24.

It is remarked that the cultivation of fruit in Ceylon is still carried on in a haphazard way without apparent attempt to develop the commercial possibilities which undoubtedly exist. It is proposed in a series of articles to describe up-to-date methods, embodying the latest information of practical value, of growing such fruits as can be produced with success in the various climatic regions of Ceylon. These latter have been divided into 5 groups, each with its own set of fruits. Groups A and B are discussed here.

Group A. Low country wet zone from sea level up to 1,500 ft. The important fruits are mango-steen, durian, grapefruit, rambutan, sapodilla, uguressa, soursop, custard apple, lovi-lovi, jam fruit. Sapodilla (*Achras Sapota*). Propagation is by selected seed, inarching or marcotting, but budding and grafting are also possible. As stocks *Bassia longifolia*, the "mee" tree of Ceylon, and *Sideroxylon dulcificum* of West Africa are suitable. Seedlings come into bearing in 5 or 6 years, inarched plants taking less time. Two crops a year are usual, though some varieties fruit nearly throughout the year. Pruning is unnecessary, the tree being of strong growth. Organic farm-yard manure is beneficial. Mangosteen (*Garcinia Mangostana*), is propagated by seed or by inarching. It is difficult to establish owing to its weak root system but grafting on to a robust stock such as Goraka (*Garcinia Cambogia*), Cochin Goraka or Kanagoraka (*G. Morella*) may prove a solution. This method is under investigation at Perideniya. Seed germinates in a month and the resulting plants must be kept shaded, otherwise death or permanent injury will result. Seedling trees fruit in 8 or 9 years. Pruning is not required other than a slight thinning of the inner branches. Light annual dressings of well-rotted cattle manure should be given. Rambutan (*Nephelium lappaceum*). Propagation is by seed or marcotting, the latter being preferable owing to the number of inferior trees in existence. Budding of good varieties on selected seedling stock is also recommended. When 3 in. high, seedlings are transplanted from the seed bed into bamboo pots, being later transferred to the open ground when 12 in. high.

Fruit is borne about the 6th year from seed. Well-decayed cattle manure applied after fruiting is beneficial.

Group B. Fruit suitable for low country, dry and semi-dry zones, preferably under irrigation. Lime (*Citrus aurantifolia*). In Ceylon this tree thrives from sea level to 3,000 ft. and prefers a rich, sandy loam, or a light, sandy loam, provided organic manure is available. A clay soil is a source of several root troubles. There is a local lime of a good type, which however does not fruit during prolonged drought or excessive wet. The British Guiana lime, introduced about 1917 and now much grown in the northern parts of the island, on the contrary bears fruit all the year round and can be recommended. Propagation is by seed and the first fruits are borne when the tree is 4 years of age. Mango (*Mangifera indica*). This tree requires the stimulus of a dry season when flowering and setting fruit. In the absence of any pronounced dry season crops are erratic. Any soil will suit the mango provided the subsoil is well drained, though a deep, sandy loam gives perhaps the best results. Propagation by seed should be avoided. The tree can be inarched, marcotted, budded or cleft grafted on seedling stock. Pruning the young trees should be restricted to a careful thinning of growth sufficient to ensure a good circulation of air among the branches. After maturity the dead wood only is cut out. Grape (*Vitis vinifera*). In the drier parts of Ceylon certain varieties of grapes have been cultivated with some success. The native grape (*Ampelocissus indica*); is useful only as a possible stock for grafting superior varieties. The grapes likely to be successful are Gordo Blanco and Waltham Cross and Black Hambro of the Australian varieties, or Buckland Sweet, Kabul Sweet and Muscat White of the Indian kinds. Propagation is usually by cuttings of wood selected from the middle of last season's canes and 10—12" in length. In pruning the drastic cutting back of the European method is not applicable in Ceylon and India. Pruning in Ceylon must be done after the growth has ripened. It should consist in the cutting out of all sub-lateral shoots, leaving the main stem and healthy laterals. The latter should be shortened back to a few buds. The rest period essential to the vine is obtained in the tropics by periodically baring the roots and exposing them to the sun for a few weeks after growth is completed and prior to the annual pruning.

291. JULIANO, J. B.

634.443-1.522

The cause of sterility in *Spondias purpurea* Linn.

Philippine Agriculturist, 1932, 21 : 15-24, bibl. 13.

Spondias purpurea, a deciduous fruit tree of importance in the Philippines, where it is known as the native plum, is practically impossible to propagate sexually, no germ being formed in the mature stone. Physiological investigation is here said to have revealed that this sterility is due to the degeneration of the mother cells of the microspores and not at all to the megagametophyte which is normal. Thus, since no pollen is ever formed, if viable seeds are to be produced, it will be necessary to attempt pollination by means of the pollen of the two other available species, *S. cytherea* and *S. lutea*. The development of fruit by *S. purpurea* is a clear case of parthenocarpy.

292. ANON.

631.541 : 634.441 + 634.653

Vegetative propagation of mangoes and avocados.

J. Jamaica Agr. Soc., 1932, 36 : 338-9.

Budding mangoes. It is contended that the theory that mangoes could only be budded by the patch bud method is incorrect. The patch bud method is wasteful since only bud wood an inch and a quarter in diameter can be used, the smaller buds having to be thrown away. Evidence is brought to show that the mango can be quite well budded by the ordinary T bud method, the names of growers practising this method being given. An improvement suggested to the author by Mr. F. A. Stockdale, Agricultural Adviser to the Secretary of State for the Colonies, is to trim off the corners of the flaps of bark on the stock at the junction of the vertical and horizontal cuts of the T, the cut portion being covered with the tying material when the bud is inserted. This allows for the greater callusing of the mango, as compared with citrus, which otherwise may be liable to lift the bud. *Avocado grafting.* The author, again quoting Mr. Stockdale, suggests that the avocado should be cleft grafted, and that, after stock and scion have

been well bound together, the whole should be covered with a cardboard or paper cap or cylinder of sufficient length to cover the cleft. This he claims should ensure a very high percentage of success. [The budding and grafting of avocados is described in *Trop. Agriculture*, 1932, 9 : 35-7, abstracted in *H.A.*, 1932, 2 : 1 : 61.—ED.]

293. MARLOTH, R. H.

634.62

The date.*Union S. Africa, Dept. of Agr., bull. 112*, pp. 20, bibl. 15.

The writer's aim is to give practical information to intending date growers in South Africa. As regards soils he notes that, although the date palm is found in soils containing 3—4% total salts, the roots must be in soil with 1% or less, if good crops are to be expected. Propagation from offshoots is recommended and an account is given of the best accepted practice in Arizona and California. Hints on planting, irrigation and manuring follow and the necessity for and methods of hand pollination are noted. Harvesting and processing are discussed. Among diseases and pests the following are noted as most serious:—The Bayoud disease, probably due to *Cylindrophora albedinis*, the wine-coloured Marlatt scale (*Phoenicoccus marlatti*), *Parlatoria blanchardii* and *Batrachedra amydraula*.

294. LLANOS, M.

634.74

The culture of the annatto and its possibilities.*Proc. Agr. Soc. Trinidad and Tobago*, 1932, 32 : 191-7.

The Annatto or Roucou (*Bixa Orellana*) is a native of S. America which has become naturalized in many parts of the Tropics. It is a tree growing up to 20 ft. in height, with heart-shaped leaves, pink flowers in terminal clusters and a heart-shaped, scarlet fruit which later turns brown and splits in two. Its commercial value lies in the seeds which produce a reddish dye used in colouring varnish, edible oils and other foodstuff, also in dyeing silk. The seeds sold locally in Trinidad fetched 12 cents per lb. and there is a probable market in Canada. Directions for cultivation which are given follow the ordinary methods for tropical tree crops, i.e. mulching, cover cropping, etc. Propagation is by seed, the tree bearing in its second year. It is suggested that the plant would make a useful shade tree for coffee, when its seeds could be utilized as a catch crop, which would bear twice a year. To prepare for market, mature pods are picked and dried in sheds. When dry they are beaten with mallets to extract the seed, which is cleaned by sifting through suitable riddles. The extracted seeds are dried for a further 3 days. The author is enthusiastic over the possibilities of this tree, estimating a profit of 56 dols. per acre of 240 trees. There is, however, an editorial note saying that the crop can never be more than a very minor one, and as an adjunct to other cultivation.

The following articles are also noted:—

HAYES, T. R. **Groundnut rosette disease in the Gambia.** *Trop. Agriculture*, 1932, 9 : 211-17, bibl. 13.

HUNTER, R. E. **The vegetative propagation of citrus.*** *Trop. Agriculture*, 1932, 9 : 135-40, bibl. 6.

LEAKE, H. M. **Studies in tropical land tenure.** *Trop. Agriculture*, 1932, 9 : 244-9, bibl. 4. This chapter deals with India.

PACKING, PROCESSING, FRUIT PRODUCTS.

295. GROVE, O.

663.32

The clarification of elders by the centrifuge method—II.†*Long Ashton Ann. Rept. for 1931*, 1932, pp. 168-70.

Results indicate that it is difficult to give a decisive check to fermentation by centrifuging juices which possess very high rates of fermentation. In the 1931-2 season the experiment will be made of passing a second time through the centrifuge after a suitable interval. The Sharples and Alfa-Laval centrifuges gave very similar results. This year a different type of Alfa-Laval is to be tried.

* See *H.A.*, 1932, 2 : 2 : 161.† See *H.A.*, 1931, 1 : 2 : 213.

296. GROVE, O. 663.32

The effect of storage temperatures on cider. III.

Long Ashton Ann. Rept. for 1931, 1932, pp. 171-3.

The author's continued experiments lead him to conclude that, provided cider of the sweet or medium sweet types is in suitable condition for bottling in respect of capacity for residual fermentation, one to two months cold storage at 1°C. is effective in maintaining in good condition the naturally conditioned, bottled cider for a much longer period than storage at ordinary cellar temperature can do. Cold storage appears to offer little or no advantage for low gravity ciders possessing but little capacity for residual fermentation. Cold storage does not effectively help in checking fermentation in prematurely bottled cider.

297. NICHOLS, P. F., AND OTHERS. 634.51 : 664.85.047

Walnut dehydrators : characteristics, heat sources, and relative costs.

Univ. Calif. Coll. Agr., Agr. Exp. Sta. bull. 531, 1932, pp. 34, bibl. 10.

An account is given with diagrams of some of the plants commonly used for drying walnuts in California and of the results of tests in 1925 and in 1930 on a large number of drying plants (42 in 1930) driven by gas, oil and electricity, together with notes on efficiency and costs. It was found that the total costs for all tests were \$5.89, \$7.61, \$8.33 per dried ton in the case of gas, oil and electrically heated plants respectively. Thus the greater thermal efficiency and absence of supervisory requirements for electrically heated plants failed to keep the costs as low as they were in other types. Moisture content of dried nuts varied excessively. No satisfactory means for automatic control of this have developed, though possible means of control are here suggested.

298. VERONA, O. 634.451 : 663.3

Esperienze sulla fermentazione del mosto di Kaki. (Fermentation of the must of persimmon.)

L'Italia Agricola, 1932, 69 : 557-61, bibl. 4.

The writer finds that the chemical composition of persimmon prevents the possibility of getting from it an agreeable drink having the nature of cider. The alcohol obtained therefrom is inadequate, saccharose is absent and there is a scarcity of non-reducing sugars. He states, however, that the addition of grape juice enables the production of a most delectable wine.

299. ANON. 634.771/3-1.57

Banana products.

Food Manufacture, 1932, 7 : 175.

Figs. This term is applied to the dried whole banana which is used when fully ripe, so that most of the starch has changed into sugar. The fruit is peeled and usually dried by exposure to the sun, being covered at night and in cloudy weather. As a mechanical drying system hot air circulated by fans in a temperature that does not rise above 140°F. is advised. The proportion of moisture in the finished product is 20% and could with advantage be reduced. The bananas arrive in England in wooden boxes containing 28 lb. and 56 lb. A suggestion is made that, if packed in cartons with attractive labels, they would be more saleable. *Banana Chips* are made from thoroughly dried green bananas. Owing to their hardness they can be readily ground into flour. To prepare chips full or three-quarter grown green bananas are immersed in very hot (not boiling) water, peeled, sliced and dried. The moisture content remaining should not exceed 10%. They pack satisfactorily in jute bags. Weevils do not attack this form of the product. *Banana Flour* is prepared in the consuming country from the imported chips, flour prepared in the producing countries being from one cause or another unacceptable. It is mainly used for invalid food or biscuits. Attempts to popularize the material for direct domestic use have so far always failed.

300. ANON. 663.93
The manufacture of coffee extract.
Food Manufacture, 1932, 7 : 206-8.

At present the production of coffee extract leaves much to be desired. Here there is general discussion of the technical difficulties involved and the opinion is expressed that, if adequate research were applied to this subject, a product could be evolved which would give a beverage at least equal to that from ground coffee.

The following articles are also noted :—

- GROVE, O. **Cider making trials for the season 1930-1.** *Long Ashton Ann. Rept. for 1931*, 1932, pp. 143-57.
PICKFORD, P. T. H. **The improvement of farm-made cider.** *Long Ashton Ann. Rept. for 1931*, 1932, pp. 158-67.
ADAMS, MARGARET L. **The domestic preservation of fruit and vegetables.** *Progress report, 1926-1931.* *Long Ashton Ann. Rept. for 1931*, 1932, pp. 177-84.
CRAWFORD, HELEN, N.D.P., AND TURNBULL, J. **Courses in apple packing.** *J. Min. Agr.*, 1932, 39 : 228-32.
THAYER, P. **Loading baskets of fruit and vegetables into cars.** *Pennsylvania State Coll. School of Agr. & Exp. Sta. circular 116*, pp. 12.
HUTCHINSON, H. P. **The value of young bat willow trees.** *Long Ashton Ann. Rept. for 1931*, 1932, pp. 185-6.

STORAGE.*

301. MARSHALL, R. E. 634.11-1.563
The construction and management of air-cooled storages with special reference to apples.
Michigan State Coll. Agr., Agr. Exp. Sta. circ. bull. 143, 1932, pp. 43.

The writer gives advice based on experiments and practical observations in Michigan during the last ten years. He discusses the principles of air-cooled storage and how best they may be observed. He deals chiefly with practical points in connection with the following :—cellar versus above-ground stores—sizes and shapes of store—heat transfer and insulating materials, including a description of different substances used and their suitability—wall construction—insulation and installation of doors—ceilings—floors—ventilation—humidity—containers—autumn and winter management. He concludes with notes on costs, conversion of air-cooled to cold storage, remodelling of existing farm buildings, storage disorders.

302. KIDD, F., AND WEST, C. 664.85.22.037
The cold-storage of English plums.
Dept. Sci. and Ind. Res. Food Investigation leaflet 1, 1932, pp. 6.

A series of trials during the last ten years show that the greatest extension of storage life was obtained at 34°F. (actual temperature of fruit). At this temperature, however, fruit which is too unripe, i.e. is firm, green and sour, fails to ripen normally. At higher temperatures, e.g. 40°F., unripe fruit ripens slowly or more or less normally. With more mature fruit, i.e. fruit which shows signs of softening, colouring and sweetening, 34°F. is definitely the best. Certain named varieties such as Coe's Golden Drop are naturally long keepers : with them careful handling, the use of suitable packages and the avoidance of too dry an atmosphere are the essentials. *Handling.* Fruit damaged, or showing any sign of brown rot, or not possessing strigs should not be stored ; wet fruit should not be stored ; condensation of moisture on the surface of fruit at removal from store should be avoided as promoting fungal rotting ; a slow rise of temperature, maximum ventilation and dry conditions should be aimed at. *Packing.* For short period storage the type of package is not of great importance except with wet fruit,

* See also 228.

when bulk packages such as bushel or half bushel sieves may lead to excessive fungal rotting in the centre. Fruit in long period storage should be examined at intervals and any showing signs of rotting removed. *Type of store.* The battery system, in which cooling is done by forced circulation of cold air, is recommended for plums. *Cultural conditions.* Wallace of Long Ashton has found that plums deficient in potash often keep longer than others, but suffer more from internal browning and jellying when stored at 34°F. *Weather conditions.* There are indications that rain in the days immediately prior to gathering shortens the natural storage life, which is shown by quicker softening and earlier browning of the flesh.

303. BARKER, J., AND MORRIS, T.

664.84/85.037

The preservation of fruit and vegetables by freezing.

Dept. Sci. and Ind. Res., Food Investigation leaflet 2, 1932, pp. 9, bibl. 9.

The writers note the advantages of the frozen or cold-pack method in many cases. Experiments both at Cambridge and in the U.S.A. show that raspberries, gooseberries, blackberries, red currants and bilberries, sour cherries and rhubarb (the last two tried only in America) can be frozen and stored at a temperature of 10°—15°F. for 5 months without serious loss of colour and flavour. On the other hand marked deterioration in flavour occurs with strawberries and in flavour and colour with cherries, plums, peas and runner beans stored at 10°—15°F. The deterioration is much less at 0°F. Freezing with sugar or syrup is found to delay such deterioration considerably, though actual amounts of sugar and methods are as yet not satisfactorily worked out. Blanching or partially cooking before freezing has also been found successful. The exclusion of oxygen from the storage atmosphere during freezing inhibits, moreover, discoloration during the process, but browning has occurred on release of the vacuum at thawing. The possibilities offered both by exclusion of oxygen and by very quick freezing at extremely low temperatures, both being devices which have had considerable success in America, need further examination. The best thawing temperatures also need investigation. In America it is considered that slow thawing over a period of 24 hours at 34°—40°F. is the best. Hints follow on freezing storage for direct consumption, it being noted that, although syrup is not essential to preserve colour with certain fruits such as raspberries, it certainly improves their flavour. Owing to discoloration the advantage of so preserving sweet cherries and plums seems doubtful. Vegetables such as runner beans, peas and possibly new potatoes thus treated are found to be much superior to canned produce. Some vegetables, e.g. asparagus, are apparently unsuitable. Hints on storage of strawberries for canning by this method are given, and it is noted that peas, runner beans and strawberries canned after such treatment are indistinguishable from those canned fresh. The article ends with a note on storage for jam and a suggestion that anyone contemplating the use of such methods should write for further information to the Low Temperature Research Station, Cambridge.

304. YOUNG, W. J., AND OTHERS.

634.771/3-1.547.6 : 656.6

The ripening and transport of bananas in Australia.

Council for Sci. and Indus. Res. (Australia), bull. 64, 1932, pp. 52.

The methods at present employed in Australia of handling, packing, transporting and ripening bananas are described. The variety mainly grown for market is the Cavendish banana. The bananas are generally detached from the bunch and packed as "singles." Bananas received in the southern cities must all be ripened artificially. This has in the past been done by the aid of gas heaters, the cases being stacked in specially constructed rooms. Since some trace of accelerating agent is necessary to ripen the fruit successfully, it is thought that this was provided by the ethylene from unavoidable leaks of gas. Ethylene being expensive in Australia, it is recommended that coal gas be used instead, a concentration of 1 part per 1,000 having been found sufficient in reasonably air-tight rooms in summer; in winter a concentration of 3 parts per 1,000 should be used. If ethylene is used, the concentration should be 1/30 of that used for coal gas. The other optimum conditions for bunch ripening are temperature 68°F., humidity in summer

85% to the "spring" stage then 70%, in winter 85% to "colour shows" stage then 70%. *Storage.* Unripe bananas can be stored at 53°—58°F. in atmospheres quite free from ethylene. These findings agree with those recorded by Wardlaw and McGuire.* Partially ripened bananas can be retarded for about 3 days without loss of flavour by cooling to 55°—60°F. at the "colour shows" stage. Suggestions are made for the construction and equipment of banana ripening rooms. A progress report on the transport of bananas issued by the Railway Commissioners of New South Wales, Queensland and Victoria is included. This is followed by a discussion by the investigators of the chilling in winter and excessive ripening in summer of bananas in transport. The condition of the fruit when packed and various methods of packing were investigated and recommendations are made for the treatment of the fruit on the plantation.

NOTES ON BOOKS AND REPORTS.

305. DARLINGTON, C. D. 631.523 + 576.312.3
Chromosomes and plant breeding. 1932. Macmillan, London. pp. 112.

The recent rapid advances in the study of cytology, especially in its bearing on tetraploidy and related phenomena as well as its increasing significance to the practical plant breeder now that the chromosome complex has come to be recognized as the physical mechanism of inheritance, have rendered particularly desirable a clear exposition of the fundamentals of cytology as related to genetics in a form easily available to the busy horticulturist or plant breeder to whom the scattered literature of the subject is not accessible. This little book, written in the first place as a series of articles in a leading horticultural journal and later slightly amplified, is designed to fulfil such a need. Dr. Darlington describes chromosome structure and behaviour in the cell of the normal diploid plant, and points out the obvious parallel between the observed pairing and separation of the chromosomes at meiosis and the segregation of factors postulated by Mendel's law. The remainder of the book is largely taken up with a consideration of the various aspects of polyploidy and its effects on the morphology and fertility of the plant. Fruit growers will find Dr. Darlington's account of triploidy in the apple, secondary polyploidy in the apple and pear, and his discussion of Crane's *Rubus* hybrids, of particular interest. The book is well illustrated with numerous photographs and diagrams and it should form a useful introduction to a more detailed study of cytogenetics. Sir A. D. Hall contributes a foreword in which he points out the importance of a knowledge of chromosome behaviour in elucidating many of the problems of the practical plant breeder.

H.M.T.

306. MINISTRY OF AGRICULTURE AND FISHERIES. 634.11-1.546-1.541.11/12
Intensive systems of apple production.

Bulletin of the Ministry 49, 1932, H.M. Stationery Office, pp. 21, bibl. 5, price 9d.

This would seem to be a cautious attempt to give some concrete information on the systems of intensive apple cultivation which have lately been brought somewhat into the limelight by such books as "How to live in England on a pension." That fruit farming of such a nature has come within the range of possibility as a result of English research work is certain, and the brief accounts of different commercial methods of applying these results are extremely interesting. Reference is made to plantations of bush trees on Malling IX (Jaune de Metz) stock in Cambridgeshire, of Cordon apple growing on Malling IX and on Malling II (Doucin), and of the so-called Dwarf Pyramid system described by Lees in *The Gardeners' Chronicle*, vol. 83, 1928, pp. 340 and 356 and vol. 89, p. 245. From an economic standpoint, however, figures are noticeably absent, while definite statements made on such points as the proper distance of planting, necessity of thinning varieties on Malling IX, inability to stand storage of apples grown on this stock, and other cultural matters, would not appear to be in accordance with recent experiment results.

* The behaviour and diseases of the banana in storage and transport. Empire Marketing Board, Rept. 36. London, 1931.

307. DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH. 664.84/85(058)
Report of the Food Investigation Board for the year 1931, 1932,
 pp. 291.

In the Report on the Low Temperature Research Station, under Section B.—Fruit and Vegetables, the following articles by different authors appear :—Biochemical study of senescence in apples, 26 pp.—Enzymic action in the frozen state at -20°F ., 1 p.—The rôle of acetaldehyde in the respiration of pears, 8 pp.—Temperature and metabolic balance in the potato, 5 pp.—Effect of ethylene on the metabolism of potatoes, 2 pp.—The gas storage of pears, 7 pp.—The influence of carbon dioxide, oxygen and rate of ventilation upon the storage, ripening and respiration of bananas, 4 pp.—Cytological study of changes in the apple during its development on the tree, 2 pp.—A cytological study of the effect of freezing temperatures on some plant tissues (apple and onion), 1 p.—Internal factors determining rate of loss of water from fruit, 1 p.—Humidity and the storage life of apples, 2 pp.—Wind-channel apparatus for the critical independent control of humidity and air-movement in fruit-storage experiments, 2 pp.—Influence of fungal invasion and mechanical injury upon the rate of carbon dioxide production of apples, 4 pp.—The action of volatile compounds on the growth of moulds, 3 pp.—The prevention of decay of stored fruit by the use of volatile compounds, 3 pp.—Wastage in imported fruit, 2 pp.—Wastage in bananas, 1 p.—Low-temperature injury in the cool storage of fruits and vegetables, 5 pp.—A critical example of the effect of small differences in temperature during storage upon the storage life of apples, 2 pp.—Vitamin content of apples, 1 p.—The preservation of fruits and vegetables in the frozen state, 4 pp. Section D. is devoted to problems of biological engineering, Section E. to canning. Part III, pp. 211-51, is concerned with work at the Ditton Laboratory and contains the following articles :—The experimental hold, 27 pp.—The uninsulated store, 3 pp.—Volatile products of the metabolism of apples, 1 p.—The waxy coating of apples, 1 p.—Leakage of carbon dioxide from gas stores for fruit, 8 pp.—Equipment for experiments in gas-storage, 2 pp. Part IV, Section B., includes articles from the Imperial College of Science and Technology on Chemical work on fruit, 12 pp. and Biological work on fruit, 19 pp.

308. CHESHUNT.

635.63/64 : 631.544

**Experimental & Research Station, Cheshunt, Ann. Rept. for 1931
 (17th year), 1932, pp. 71.**

Reports are given on the different branches of investigational work in progress. A summary of work is given in the introduction, from which the following notes are taken. In manurial experiments with tomatoes indication was given that organic forms of nitrogen were more effective than inorganic. Repeated experiments have shown that the crop after unchecked growth is greater than that when plants are "stopped" at the fifth truss and others allowed to continue vertical growth unchecked. Houses steamed for 1931 showed a crop increase of 24% over the control, while treatment with formaldehyde gave little response. The incorporation of various organic substances with the soil after steaming had very good results. Such substances were sphagnum peat and clean chrysanthemum roots, while the use of plain wheat and oat straw, at 3 tons per top spit of soil and 3 tons per second spit has proved useful in several nurseries. Liming experiments tend to show that the value of lime for tomato soils has been overestimated, except in cases where it is necessary to improve tilth. Breeding tomato varieties resistant to leaf mould (*Cladosporium fulvum*) continues. Results of experiments with a completely automatic, oil-fired boiler showed the great uniformity in temperatures obtainable by this method. In cucumber experiments good crops were grown in beds made from baked cucumber soil and straw, while virgin soil was found not to contain enough nitrogen and to need some stable manure in addition to straw. The addition of peat did not improve crop production. Lettuces have for 4 years been grown successfully as a catch crop before tomatoes. Experimental work on the control of such pests as red spider mite, white fly, cucumber root flies, is described. Temperature trials have shown that, although under normal heating conditions in glass-houses the optimum temperature for tomato growth is about 63° — 65°F .,

the crop yield can be appreciably increased by increasing temperatures of both air and soil to approximately 68°F. Mosaic disease investigations continue. An examination of drainage water from tomato houses shows that appreciable losses of potash and nitrogen occur in this way.

309. WYE. 63(072) (05)
Journal of the South-Eastern Agricultural College, Wye,
 Kent, No. 30, 1932, pp. 274.

The chief articles of horticultural interest are—The small hop disease—The control of apple scab on Worcester Pearmain and Allington Pippin—The control of apple scab. 1.—Allington Pippin and Newton Wonder*—Studies on the ovicidal action of winter washes, 1931 trials*—Biological control of insect and weed pests*—The strawberry blossom weevil—Pyrethrum*—Apple rootstocks I to XVI*—Potato manurial trials—Pollination in relation to cherry orchards.* There are also various articles on soils, including four on the soils of Kent.

310. TEXAS. 63(072) (058)
Texas Agricultural Experiment Station, 44th Ann. Rept., 1931,
 pp. 193.

Pages 19-28 are devoted to horticulture. In these very brief notes show that investigations are taking place on the following:—Rubus—breeding—cultivation of blackberry and dewberry; Citrus—adaptation and breeding—rootstocks—growing of grapefruit—cold storage; Dates—adaptation and breeding; Figs—pruning; Grapes—adaptation and breeding; Pecan—variety study and breeding—fruit setting—propagation; Rosaceae—cytological studies; Truck crops—adaptability investigation; Musk melons—breeding for purification purposes; Tomatoes—growth—breeding for wilt resistance—"tomato pocket"; Vegetables—varieties; Ornamentals—adaptability investigations.

311. IOWA. 63(072) (058)
Report on agricultural research for the year ending June 30th,
1931, of the Agr. Exp. Sta., Iowa, State Coll. Agr., pp. 128.

Pages 93-106 give very short accounts of the following projects and their progress. Storage of gladiolus corms; breeding of roses, chrysanthemums, amaryllis and carnations; gladiolus varieties; methods of propagating apples on their own roots; growing uniform stocks for propagation of standard varieties of apples [from seed—ED.]; correlation of bound water in apple wood with hardness; comparison of various waxes in the operation of grafting; development of desirable new stocks for apples [a hardy dwarf stock offers promise. ED.]; soil management for apple orchards; perfecting a method of grafting to prevent formation of callus growth; loss of apples in cold storage; processes concerned in fruit ripening as related to storage; responses of different varieties of apples to different storage temperature; effects of continued application of nitrates on the composition of apples and their keeping qualities in cold storage; apple breeding; pear breeding; plum breeding; improved varieties of peaches; hybridization of black raspberries; propagation of difficult and unusual varieties and species of nursery and greenhouse plants; natural and cool air storages for Iowa; sweet corn breeding; potato breeding; asparagus culture; changes in pectin in tomatoes in storage; systematic studies of the capsicums; cucurbit breeding; association of vitamins with nutritional conditions in plants; effect of various containers on the growth of vegetable plants.

* Separate abstracts are given of these.

312. PILLNITZ. 634/5(072) (058)
*Tätigkeitsbericht der höheren Staatslehranstalt für Gartenbau zu Pillnitz bei
 Dresden 1922-32.*
 (Report on the activity of the State Horticultural College at Pillnitz), pp. 128.

This report gives a very short account of the chief activities of this Station, fuller accounts being published elsewhere in the *Züchter, Gartenbauwissenschaft, Obst. u. Gemüsebau, Gartenwelt*, etc. In the fruit-growing department breeding work is being carried out on strawberries, and variety trials with red currants, gooseberries, raspberries, sweet and sour cherries, plums, peaches, pears and apples. Considerable attention is paid to rootstock work and vegetative propagation, and steps are being taken to try out in different parts of Germany the rootstocks which have shown their value under Pillnitz conditions. A concise summary is given of Schindler's important root box investigations, which give the following indications:—The root system is found to spread far beyond the circumference of the branches especially in dry, poor, shallow soil. The habit of roots, shallow or deep, is inherited, but may be influenced by the scion, the type of soil or by damage suffered. Thus sandy, dry soils rich in humus tend to produce root branching; nitrogen deficiency longer roots; acidity few root hairs. Pruning induces branching, but does not alter the inherent habit of the root. On reaching an impenetrable layer roots will move over its surface till they can follow the track of an earthworm or some line of less resistance. Careless cultivation may badly damage surface rooters. Grass is definitely harmful to root growth despite all watering and manuring, though its effects are lessened by keeping short (*H.A.*, 1931, 1 : 3 : 231). Experiments are also in progress on paper mulching strawberries and currants. Other departments deal with research on vegetables, fruit products, viticulture, ornamental gardening, chemical problems, plant protection.